MARITIMES RESEARCH VESSEL SURVEY TRENDS

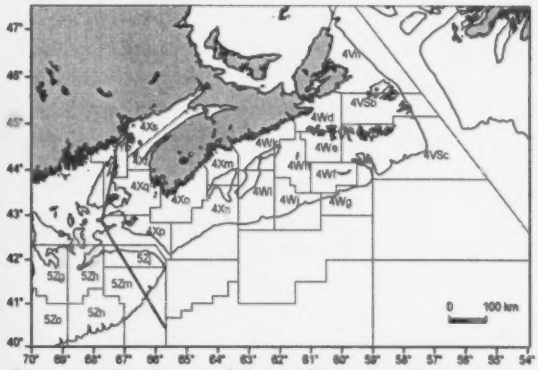

Figure 1: Northwest Atlantic Fisheries Organization (NAFO) Unit Areas.

Context

DFO has conducted summer research vessel (RV) surveys in the Maritimes Region, Northwest Atlantic Fisheries Organization (NAFO) subunits 4VWX and a small portion of 5Y, using a standardized protocol since 1970 and on Georges Bank (5Z) since 1987. Results of these surveys provide information on trends in abundance for most groundfish species in the Maritimes Region. While these data reflect trends in biomass and abundance and are a critical part of science-based stock assessments, a full assessment, including other sources of data, would be required to evaluate the impacts of management measures on population status. Fisheries and Aquaculture Management (FAM) requested a review of the DFO RV survey information on the following list of fish stocks: 4Vn cod, 4VsW cod, 4X5Y cod, 4VW haddock, 4VW white hake, 4X5Y white hake, 4VWX silver hake, 4VWX+5 pollock, Unit II redfish, Unit III redfish, 3NOPs4VWX+5 Atlantic halibut, 4VW flatfish, and 4X5Y flatfish, 4VW, 4X, and 5Z smooth skate, thorny skate, barndoor skate, winter skate, little skate, Atlantic wolffish, monkfish and longhorn sculpin as well as 4VWX spotted wolffish and northern wolffish. Full assessments will not be conducted for these stocks in 2011. The survey information will be used by DFO Resource Management as background for discussions with various industry stakeholders on recommendations for management measures, and to determine which stocks should be reviewed in more detail in 2012.

This Science Response report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Regional Science Special Response Process (SSRP) of November 3, 2011.

Canada

Background

The DFO summer research vessel (RV) survey of the Scotian Shelf and Bay of Fundy has been conducted annually since 1970. The Georges Bank (5Z) winter RV survey has been conducted annually since 1987. The surveys follow a stratified random sampling design, and include sampling of fish and invertebrates using a bottom otter trawl. These surveys are the primary data source for monitoring trends in species distribution, abundance, and biological condition within the region. There were changes to the net used and the vessel conducting the survey in 1982 and 1983, along with some changes in data collection protocols. These changes may affect the biomass trends for some species. For long-term averages, the most appropriate starting point has been selected for each species (for details see Clark and Emberley, 2011).

The bottom trawl surveys were designed to provide abundance trends for fish and invertebrates between depths of about 30 m to 400 m. Survey indices are expected to be proportional to abundance for most species. The distribution of some species, such as cusk and turbot, may not be fully covered by the survey. Abundance trends for these species may only provide indication of direction of change over time. Similarly, for pelagic species, such as herring, which are distributed broadly throughout the water column, bottom trawl catches may not reflect abundance trends. For all these species, other biological information collected during the RV surveys, such as length and weight, will still be useful for analysis.

For the purpose of this report, the 4VWX survey area has been divided into three zones based on oceanography and biogeography (Fig. 2). Catch distribution plots are provided for the entire summer RV survey area. Biomass index trends are shown for the entire summer RV survey area, as well as for three separate regions: Eastern Scotian Shelf (4VW; strata 440-466), Western Scotian Shelf (4X East; strata 470-481), and Gulf of Maine/Bay of Fundy (4X West; strata 482-495). Differences in patterns of fish abundance and species composition are apparent for these regions during the survey.

Comparisons of 2010 and 2011 length frequencies to the long-term mean are also included for major commercial fish species, using data from the geographic areas that are used in assessments for those stocks.

Monitoring data for several species that are generally caught in the groundfish fishery are included from both the summer RV survey and the Georges Bank RV survey. These species include skate species, wolffish, monkfish and longhorn sculpin.

Biomass trends provided for Georges Bank include data from survey strata 5Z1 – 5Z4 (5Zjmnh). These strata are used for calculating indices of abundance for the Eastern Georges Bank assessments of cod, haddock and yellowtail flounder which are reviewed by the Transboundary Resource Assessment Committee (TRAC).

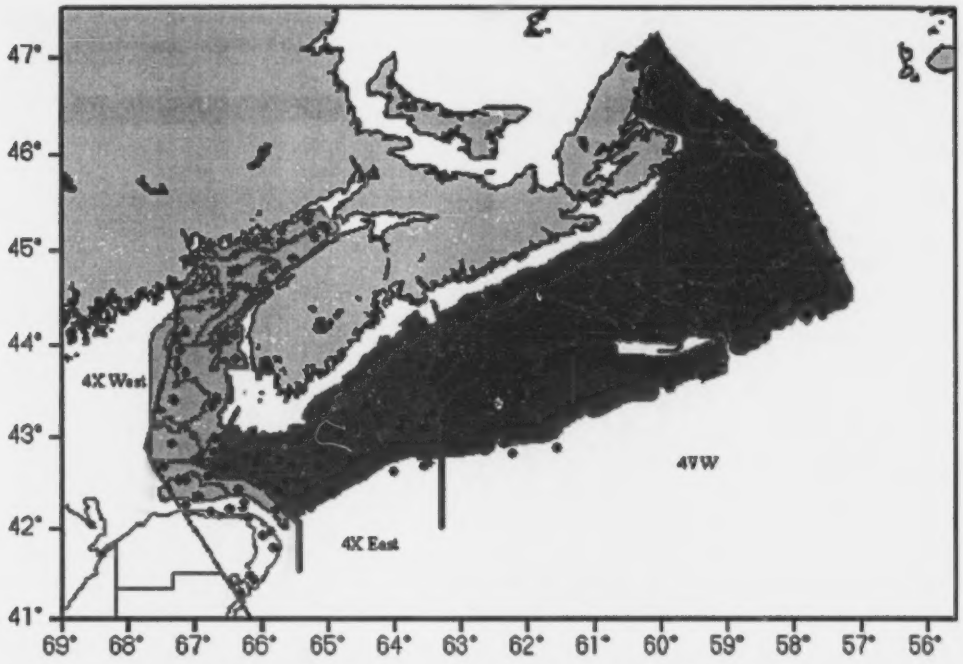

Figure 2. 2011 Summer Research Vessel Survey station distribution. Geographic areas (strata) used in calculating catch for 4VW, 4X East and 4X West are indicated.

Analysis

Biomass indices from 2010 and 2011 are compared to averages for a series of time periods to provide historical context for biomass levels.

Table 1. Comparison of 2011 biomass estimate (mt) with 2010 estimate, short-term 5 year average (2005-2009), medium-term 15 year average (1995-2009), and the long-term survey average (1970-2009 for 4X and 4VW, 1987 – 2009 for 5Z).

Stock/Region	2011	2010	Short-term Avg.	Medium-term Avg.	Long-term Avg.
4VsW Cod	27,771	35,003	26,606	14,371	54,002
4Vn Cod	4,228	6,488	4,191	5,397	16,242
4X5Y Cod (4X East)	2,091	1,835	3,213	4,663	8,428
4X5Y Cod (4X West)	1,685	1,203	4,974	10,809	13,412
4VW Haddock	28,763	48,339	79,637	63,521	61,228
4VW White Hake	4,850	5,507	5,719	6,047	10,414
4X5Y White Hake (4X East)	1,738	1,748	1,555	1,602	2,759
4X5Y White Hake (4X West)	7,626	12,587	11,304	11,865	16,435
4VW Silver Hake	43,366	29,024	15,570	18,783	*23,885
4X5Y Silver Hake (4X East)	8,151	8,764	4,976	5,887	*10,077
4X5Y Silver Hake (4X West)	3,638	61,940	2,281	4,229	*4,122
4VW Pollock	26,624	4,429	13,840	8,918	16,528
4X5Y Pollock (4X East)	129,074	13,378	10,927	8,945	17,596

Stock/Region	2011	2010	Short-term Avg.	Medium-term Avg.	Long-term Avg.
4X5Y Pollock (4X West)	5,715	5,826	54,781	29,496	25,924
4VW Redfish	144,992	117,253	55,029	42,594	65,009
4X5Y Redfish (4X East)	80,816	43,251	118,934	67,731	44,801
4X5Y Redfish (4X West)	44,025	28,642	62,765	31,960	22,555
4VW American Plaice	9,618	12,038	18,754	17,125	24,912
4VW Witch Flounder	5,119	3,955	5,843	3,833	3,938
4X5Y Witch Flounder (4X East)	225	241	452	659	674
4X5Y Witch Flounder (4X West)	263	2,084	867	892	1,210
4VW Yellowtail Flounder	11,615	10,197	11,814	10,074	13,782
4X5Y Winter Flounder (4X East)	1,152	404	598	1,058	560
4X5Y Winter Flounder (4X West)	2,438	12,580	4,422	3,403	2,669
Atlantic Halibut in 4VWX	6,777	8,277	5,944	3,463	3,116
4VW Atlantic Wolffish	483	415	586	976	2,072
4X Atlantic Wolffish	638	348	464	1,388	2,236
5Z Atlantic Wolffish	11	0	50	154	302
4VW Monkfish	1,178	681	1,228	1,505	3,399
4X Monkfish	732	235	1,009	1,457	2,379
5Z Monkfish	20	13	56	119	133
4VW Smooth Skate	119	131	194	242	492
4X5Y Smooth Skate (4X East)	0.23	54	63	45	135
4X5Y Smooth Skate (4X West)	344	539	392	287	356
5Z Smooth Skate	14	28	7	9	10
4VW Thorny Skate	4,594	2,015	5,480	5,049	12,161
4X5Y Thorny Skate (4X East)	0.48	49	244	347	1,647
4X5Y Thorny Skate (4X West)	231	195	795	909	2,588
5Z Thorny Skate	72	72	64	125	184
4VW Barndoor Skate	671	1,015	146	116	204
4X5Y Barndoor Skate (4X East)	269	424	986	380	201
4X5Y Barndoor Skate (4X West)	97	2,077	1,276	659	298
5Z Barndoor Skate	292	214	93	181	142
4VW Winter Skate	408	439	466	1,223	3,811
4X5Y Winter Skate (4X East)	388	457	361	356	341
4X5Y Winter Skate (4X West)	341	816	378	562	639
5Z Winter Skate	4,491	9,965	8,945	10,481	14,610
4VW Little Skate	143	0.12	85	110	139
4X5Y Little Skate (4X East)	527	166	449	331	226
4X5Y Little Skate (4X West)	328	798	350	740	547
5Z Little Skate	2,279	3,476	6,376	7,572	7,508
4VW Longhorn Sculpin	1,300	3,847	4,218	3,085	2,920
4X5Y Longhorn Sculpin (4X East)	1,216	449	781	743	422
4X5Y Longhorn Sculpin (4X West)	747	941	1,493	1,275	1,195
5Z Longhorn Sculpin	742	774	2,528	10,361	9,378

*Silver hake, long-term average is for 1982-2009.

Atlantic cod catches were widespread in the survey area but most catches were small (<50 Kg; Fig. 3a). The biomass index for 4Vn cod, while low in recent years compared to the long-term average, was above both short and medium-term averages in 2010, but declined in 2011 and was below the medium-term average. In 4VsW the biomass indices in both 2010 and 2011 were above the short and medium-term averages. The biomass index has declined from 2009, which was above the long-term average and the highest since 1987. In 2010, the biomass index in 4X East was the fourth lowest in the time series, while in 4X West it was the lowest in the series. Biomass indices increased in both 4X East and 4X West in 2011 but remained below recent, medium and long-term averages in both areas (Fig. 3b, Table 1). Abundance indices for 4Vn cod were well below average for all lengths in 2011, while in 2010 they were at or above average for lengths less than 45 cm (Fig. 3c). In 4VsW, abundance in 2010 was above average for lengths 3-14 cm and 63-71 cm, but below average for all other lengths (Fig. 3d). In 2011, while abundance indices were below average for most lengths, they were again above average for the smallest lengths and also from 28-34 cm. Cod abundance in 4X East and 4X West was below average for all lengths except for some length groups below 20 cm (Figs. 3e and 3f).

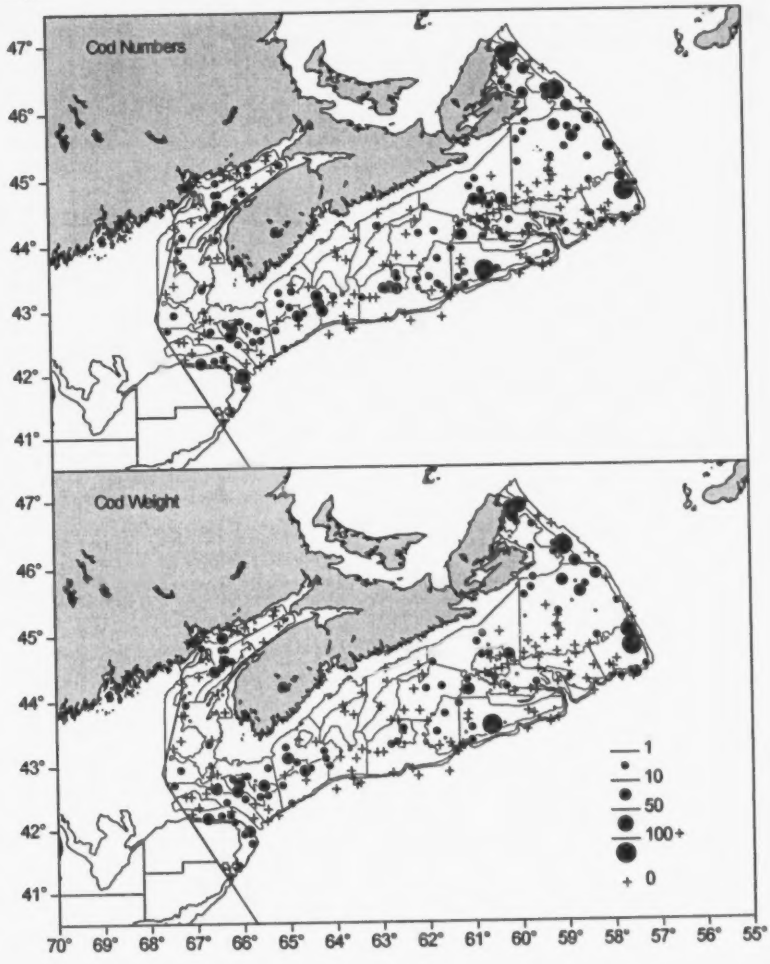

Figure 3a. Distribution of cod catches during the 2011 summer RV survey.

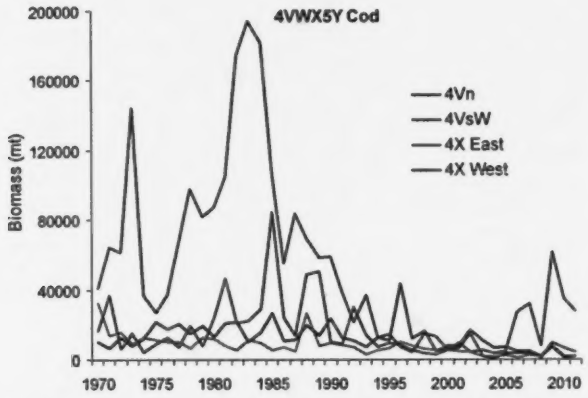

Figure 3b. Biomass estimate for cod in 4VWX5Y from the summer RV survey.

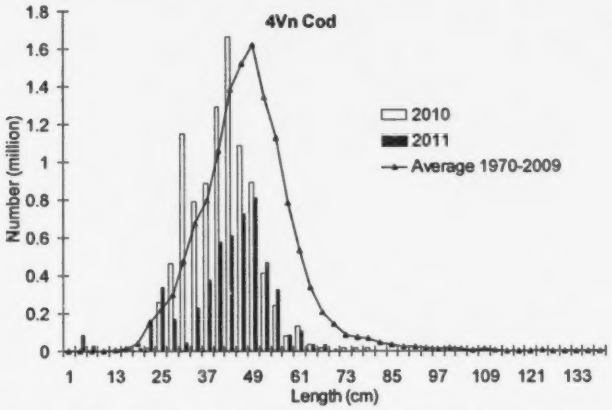

Figure 3c. Length composition for cod in 4Vn from the summer RV survey.

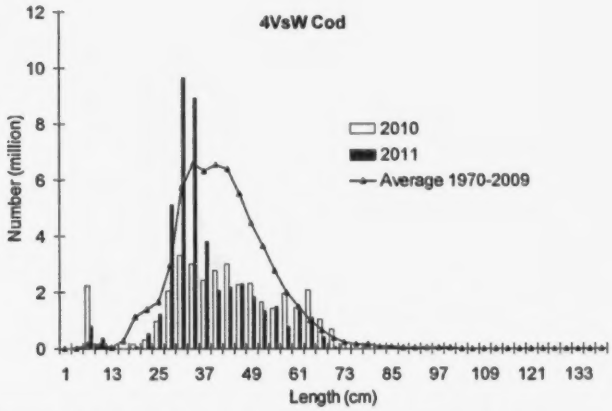

Figure 3d. Length composition for cod in 4VsW from the summer RV survey.

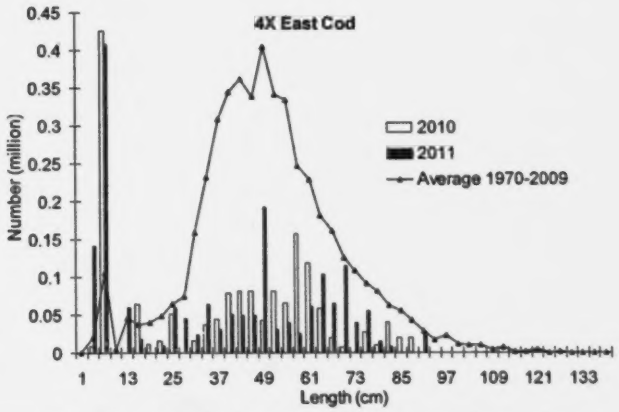

Figure 3e. Length composition for cod in 4X East from the summer RV survey.

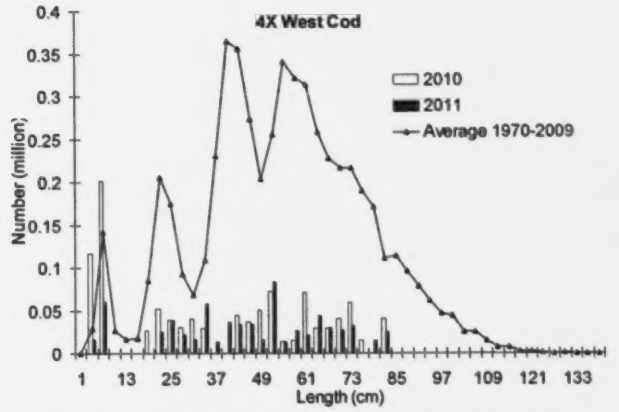

Figure 3f. Length composition for cod in 4X West from the summer RV survey.

Haddock catches were widespread in 4WX in 2011 (Fig. 4a). The biomass indices declined in 4VW to the lowest seen since 1976 and were below short, medium and long-term averages in both 2010 and 2011 (Fig. 4b, Table 1). The 4VW abundance indices for 2011 are below average for most lengths greater than 11 cm and are above average for lengths greater than 11 cm (Fig. 4c).

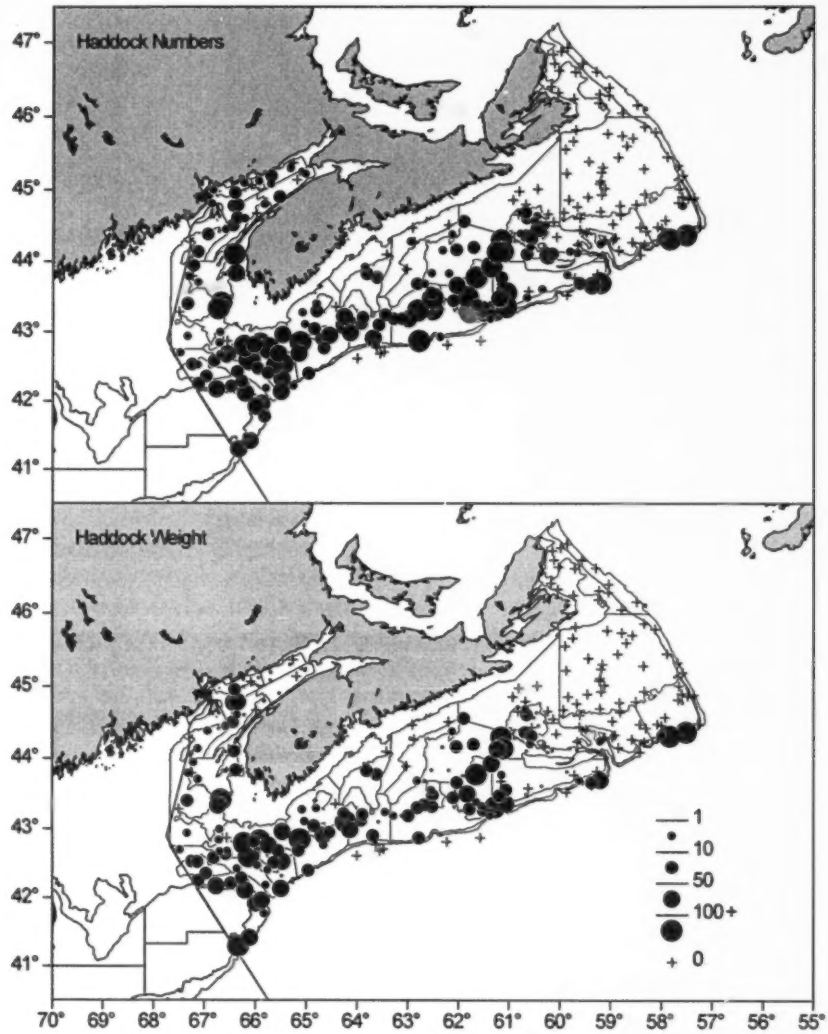

Figure 4a. Distribution of haddock catches during the 2011 summer RV survey.

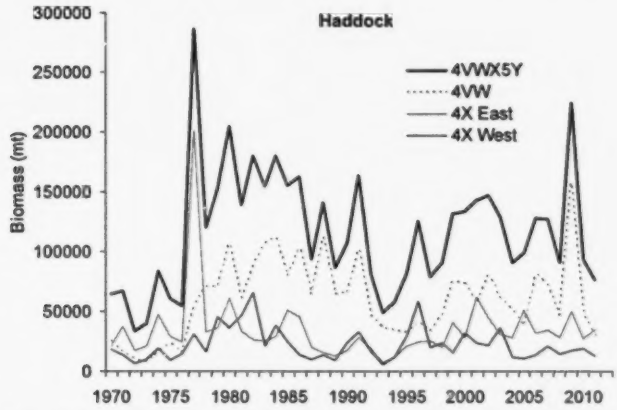

Figure 4b. Biomass estimate for haddock in 4VWX5Y from the summer RV survey.

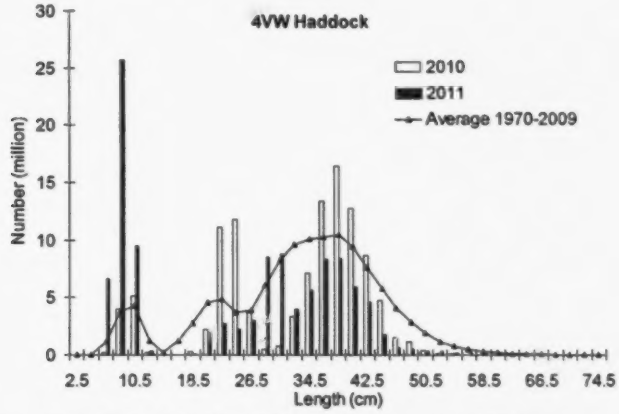

Figure 4c. Length composition for haddock in 4VW from the summer RV survey.

White hake remain distributed throughout the survey area, with the largest catches in the Gulf of Maine (4Xpq) and in 4Vn (Fig. 5a). Biomass indices in 4VW and 4X West were below the short, medium and long-term averages in 2011, but remained above the short and medium-term averages in 4X East (Fig. 5b, Table 1). Abundance indices in 2011 were below average for most lengths in 4VW (Fig. 5c), 4X East (Fig. 5d) and 4X West (Fig. 5e).

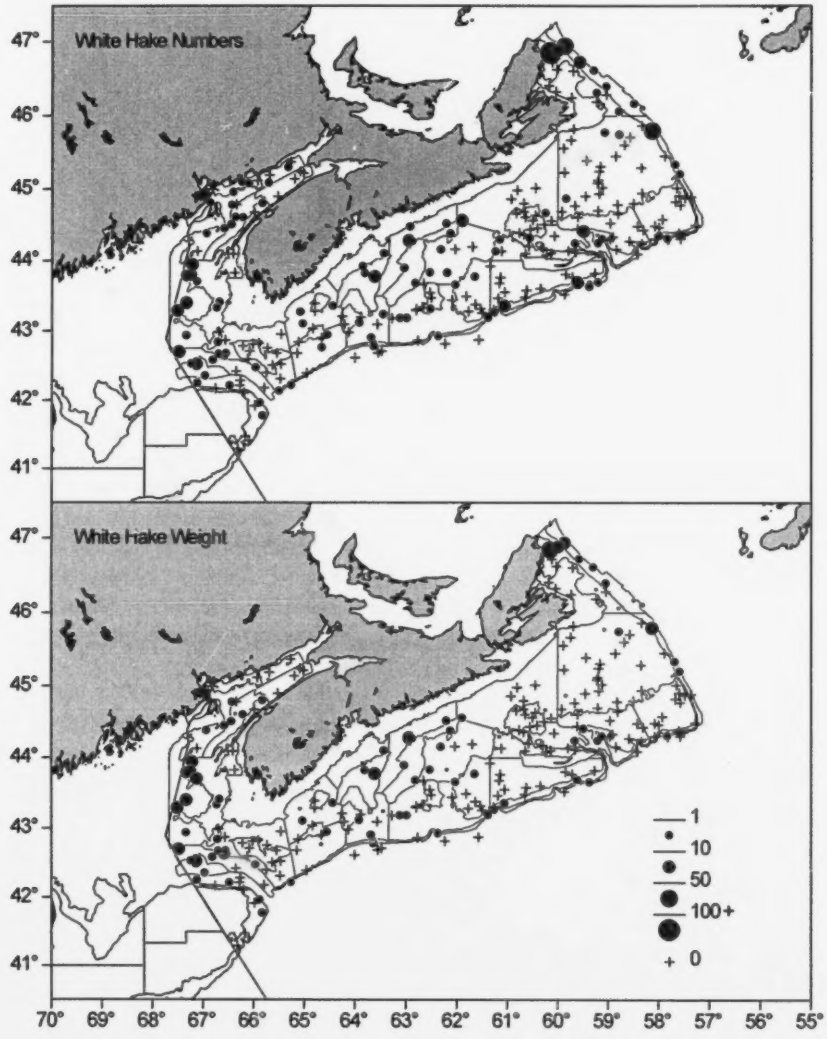

Figure 5a. Distribution of white hake catches during the 2011 summer RV survey.

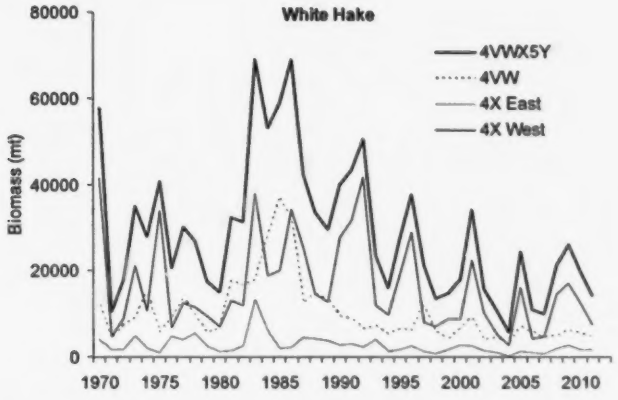

Figure 5b. Biomass estimate for white hake in 4VWX5Y from the summer RV survey.

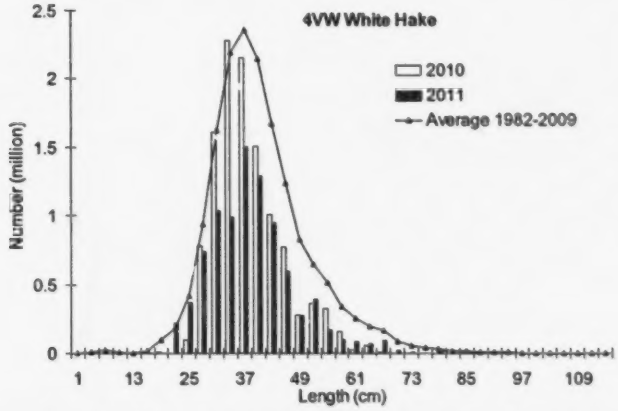

Figure 5c. Length composition for white hake in 4VW from the summer RV survey.

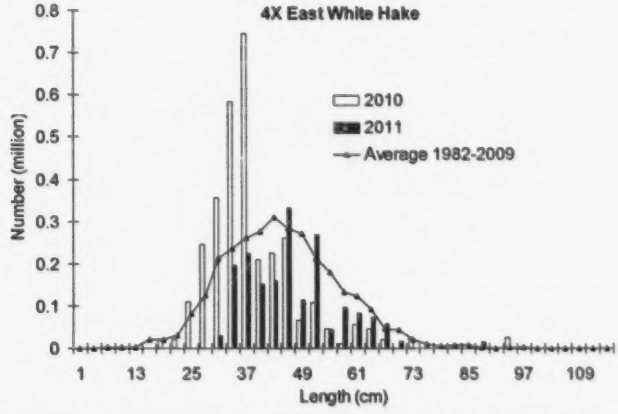

Figure 5d. Length composition for white hake in 4X East from the summer RV survey.

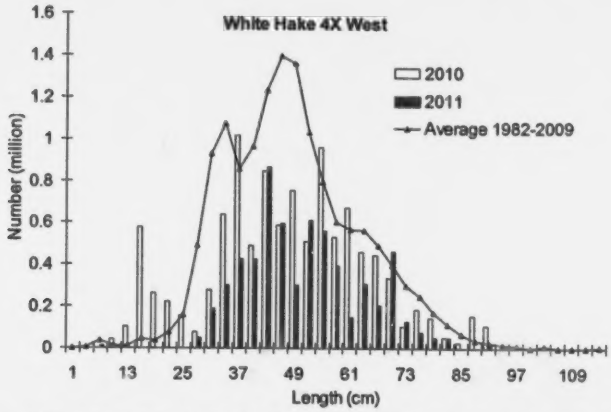

Figure 5e. Length composition for white hake in 4X West from the summer RV survey.

Catches of **silver hake** in the 2011 survey were widespread in 4W and 4X (Fig. 6a). The biomass index in 4VW increased in 2011 and remains well above short, medium and long-term averages. In 4X East, biomass remained close to the 2010 estimate and is above short and medium-term averages, but below the long-term average. In 4X West, biomass declined from the anomalously high value observed in 2010 (due to one large catch in 4Xs) and was above the short-term average but below the medium and long-term averages (Fig. 6b, Table 1). Indices of abundance are displayed for silver hake based on the assessment area, which comprises strata 440-483 (4VWXmnop). The 2011 abundance indices are well above average for lengths from 17 - 23 cm, but below average for most other lengths (Fig. 6c).

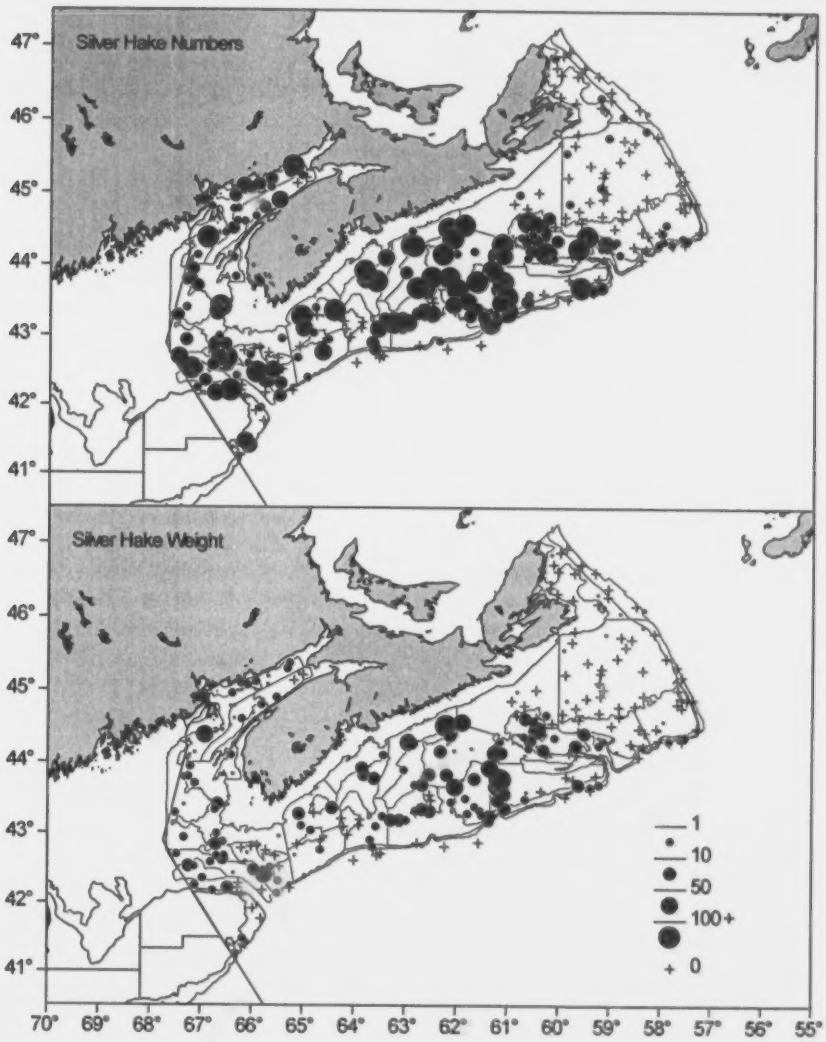

Figure 6a. Distribution of silver hake catches during the 2011 summer RV survey.

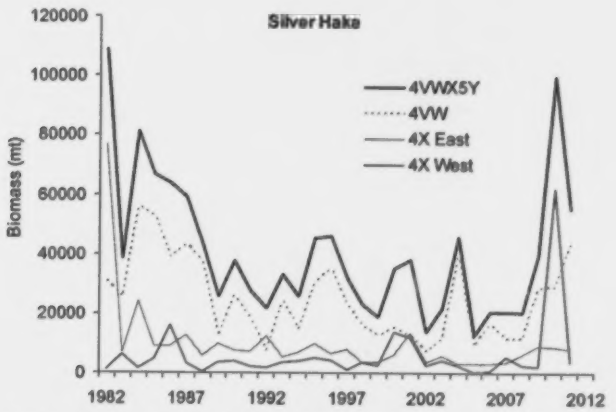

Figure 6b. Biomass estimate for silver hake in 4VWX from the summer RV survey.

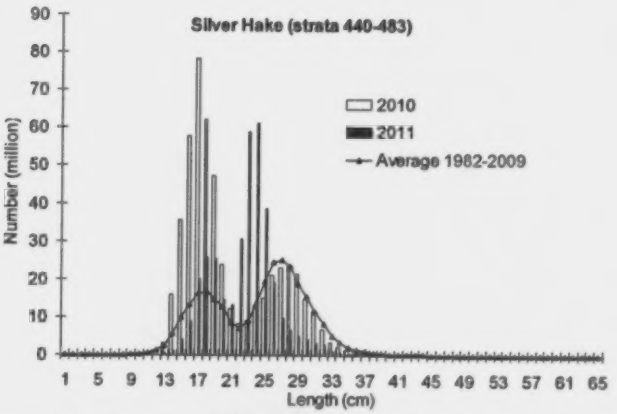

Figure 6c. Length composition for silver hake in strata 440-483 (4VWXmnop) from the summer RV survey.

Pollock catches were widespread in 4WX and 5Z. Several large catches were taken in the Eastern component strata, and in 5Z; however, no large sets were taken in the strata used for calculating indices for the Western component of Pollock (Fig. 7a). This is the first year that Georges Bank strata have been included in the summer RV survey and these sets are not included in biomass calculations. Biomass in 4VW increased in 2011 and was above the short, medium and long-term averages. In 4X East the 2011 estimate was the highest in the survey series. The biomass estimate in 4X West was similar to 2010 and was the lowest observed since 1983; well below short, medium and long-term averages (Fig. 7b, Table 1). Abundance indices in the Eastern component were well above average in 2011 for most lengths below 64 cm (Fig 7c). In the Western component, the abundance indices were well below average in 2011 for almost all lengths, similar to what was observed in 2010 (Fig. 7d).

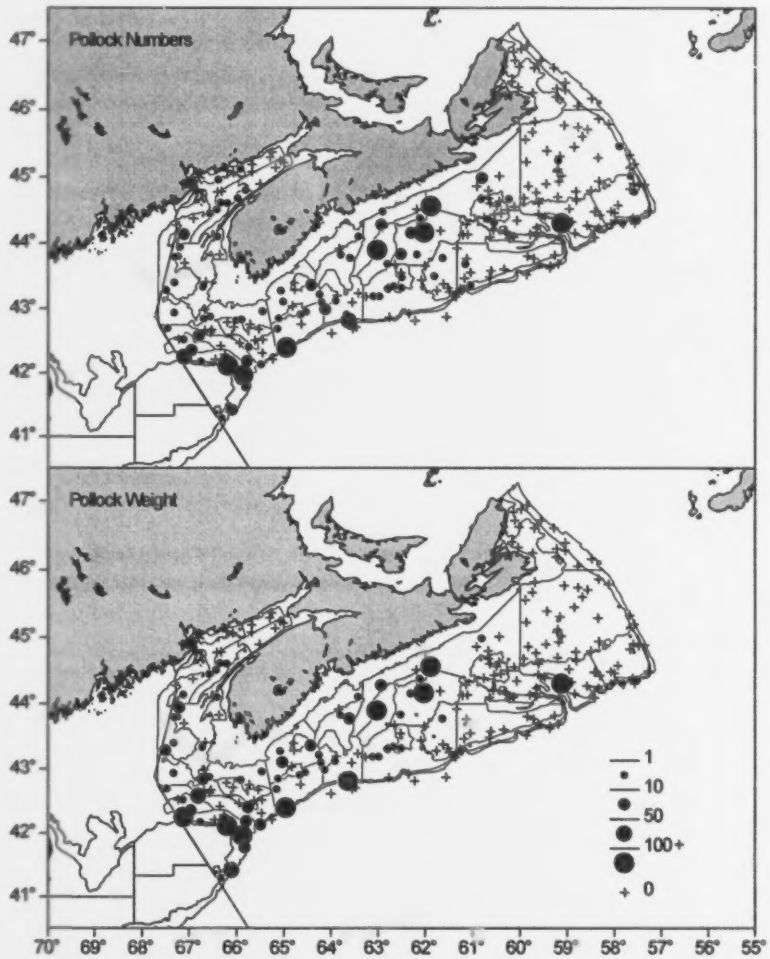

Figure 7a. Distribution of pollock catches during the 2011 summer RV survey.

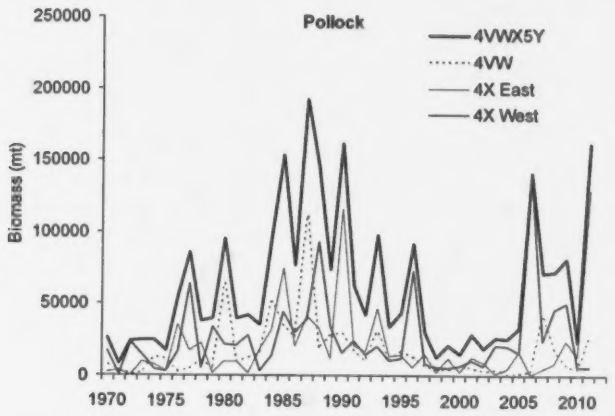

Figure 7b. Biomass estimate for pollock in 4VWX5Y from the summer RV survey.

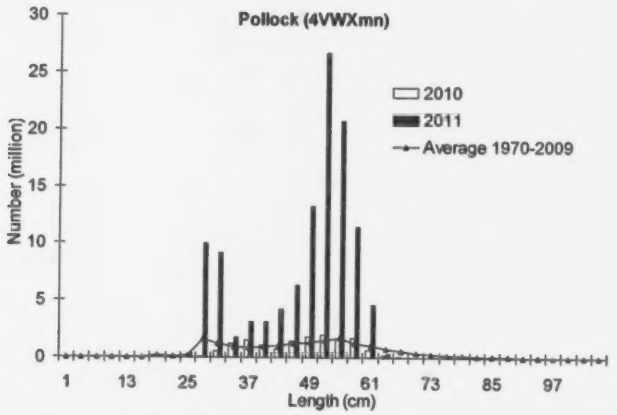

Figure 7c. Length composition for pollock in the Eastern component from the summer RV survey.

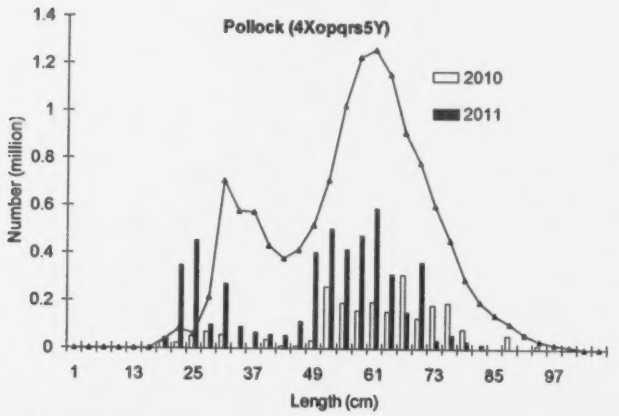

Figure 7d. Length composition for pollock in the Western component from the summer RV survey.

Redfish catches were widespread throughout the survey area (Fig. 8a). The biomass index in 4VW has increased annually since 2007 and, in 2011, is at its highest level in over 20 years; higher than short, medium and long-term averages. In 4X East the biomass index was the highest for the series in 2009. In 2011, it was above both the medium and long-term averages. The Redfish biomass index in 4X West in 2011 was also below the short-term average but above the medium and long-term averages (Fig. 8b, Table 1). For Unit II redfish in 4VWfg, abundance indices are above average for large fish, but below average at lengths <19 cm (Fig. 8c). Abundance indices at length for Unit III redfish in 4WdehkIX for 2011 are generally higher than 2010 levels at most lengths, and well above average for lengths 20-27 cm (Fig. 8d).

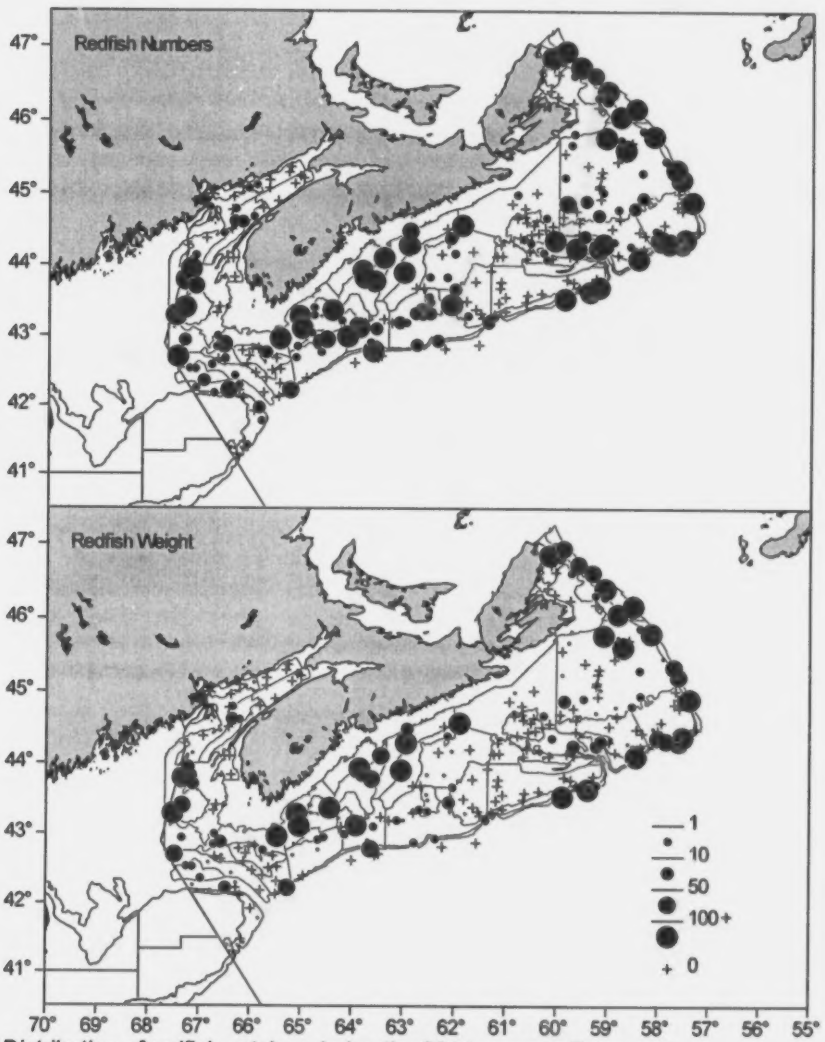

Figure 8a. Distribution of redfish catches during the 2011 summer RV survey.

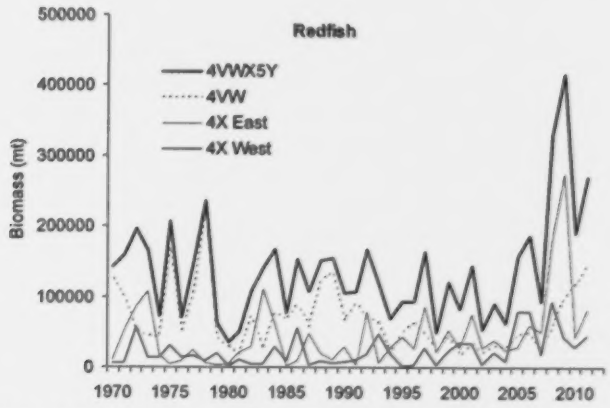

Figure 8b. Biomass estimate for redfish in 4VWX5Y from the summer RV survey.

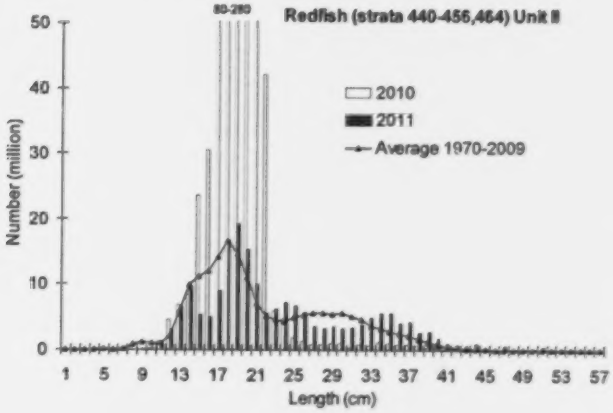

Figure 8c. Length composition for redfish in Unit II from the summer RV survey.

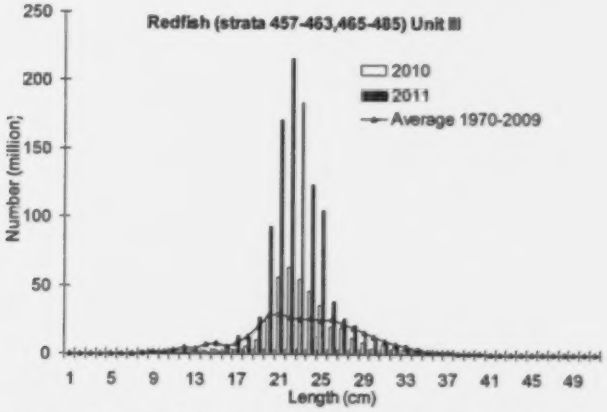

Figure 8d. Length composition for redfish in Unit III from the summer RV survey.

The three species that constitute **4VW flatfish** are American plaice, witch flounder, and yellowtail flounder. Winter flounder and witch flounder are the two main species that make up **4X5Y flatfish** but this species group also includes American plaice and yellowtail flounder. Details on each individual species are presented below.

American plaice were widespread throughout the survey area in 2011, with the largest catches primarily in 4V (Fig. 9a). Biomass indices in 4VW reached a recent peak in 2006 but have declined annually since then. The 2011 biomass index was below short, medium and long-term averages and is the third lowest in the series. American plaice catches in 4X comprise a very small portion of the total catch. In 2011 biomass indices in 4X East and 4X West were below short, medium and long-term averages (Fig. 9b, Table 1). Abundance indices in 4W for 2011 were similar to those for 2010. All lengths are below average, with the exception of some of the lengths less than 18 cm (Fig. 9c).

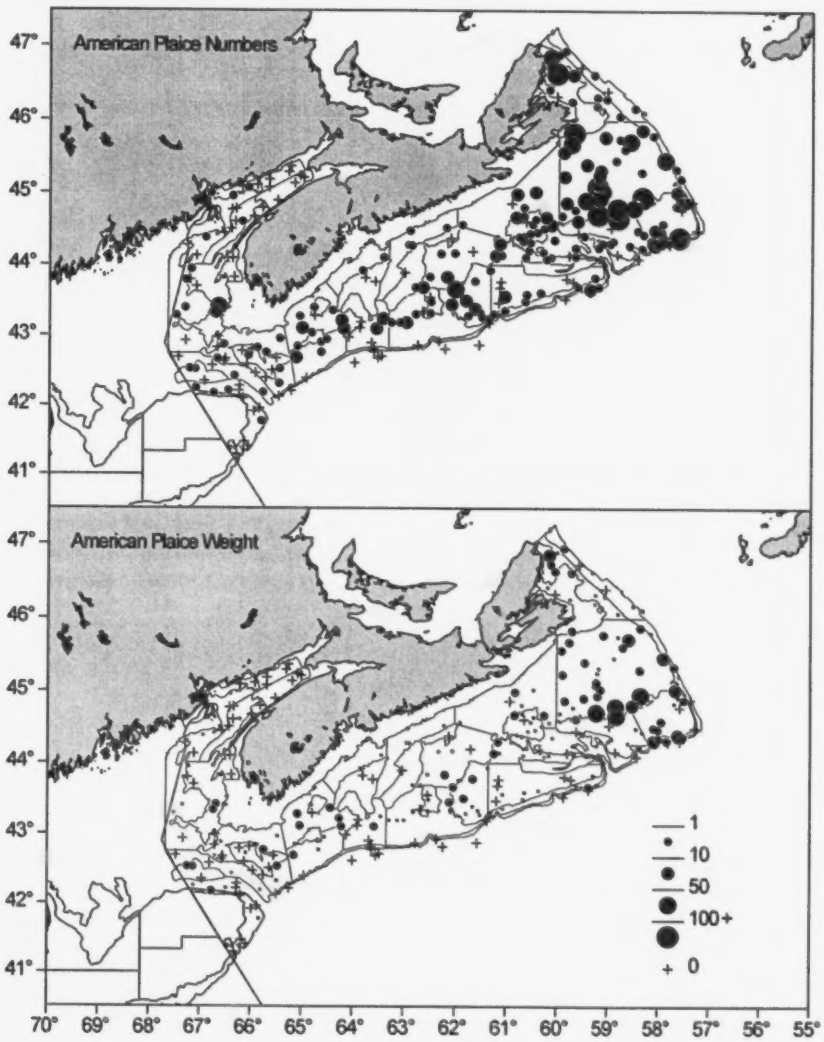

Figure 9a. Distribution of American plaice catches during the 2011 summer RV survey.

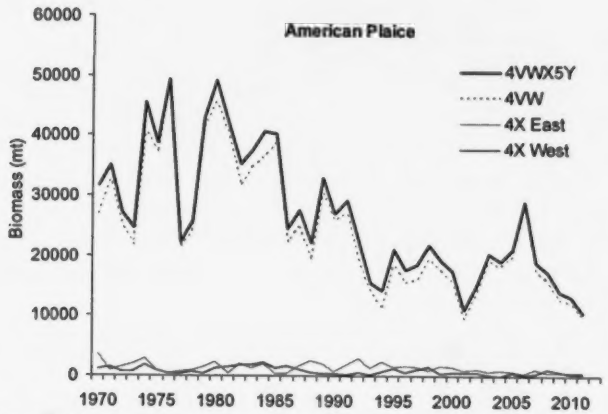

Figure 9b. Biomass estimate for American plaice from the summer RV survey.

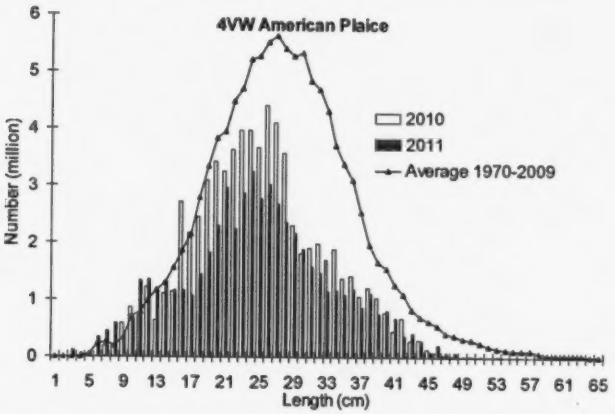

Figure 9c. Length composition for American plaice in 4VW from the summer RV survey.

Witch flounder were caught throughout the survey area with the largest catches taken in 4V (Fig. 10a). In 2011, the biomass index in 4VW was below the short-term average but above the medium and long-term averages. In 4X East, the biomass indices in both 2010 and 2011 were below short, medium and long-term averages. In 4X West, biomass decreased in 2011 and was below short, medium and long-term averages (Fig. 10b, Table 1). Abundance indices for 4VW were above average for most lengths below 40 cm in both 2010 and 2011 but below average at greater lengths (Fig. 10c). In 4X East and 4X West, abundance was below average for most lengths and very low for lengths >42 cm (Figs. 10d and 10e). Witch flounder over 49 cm continued to be absent from the survey catches.

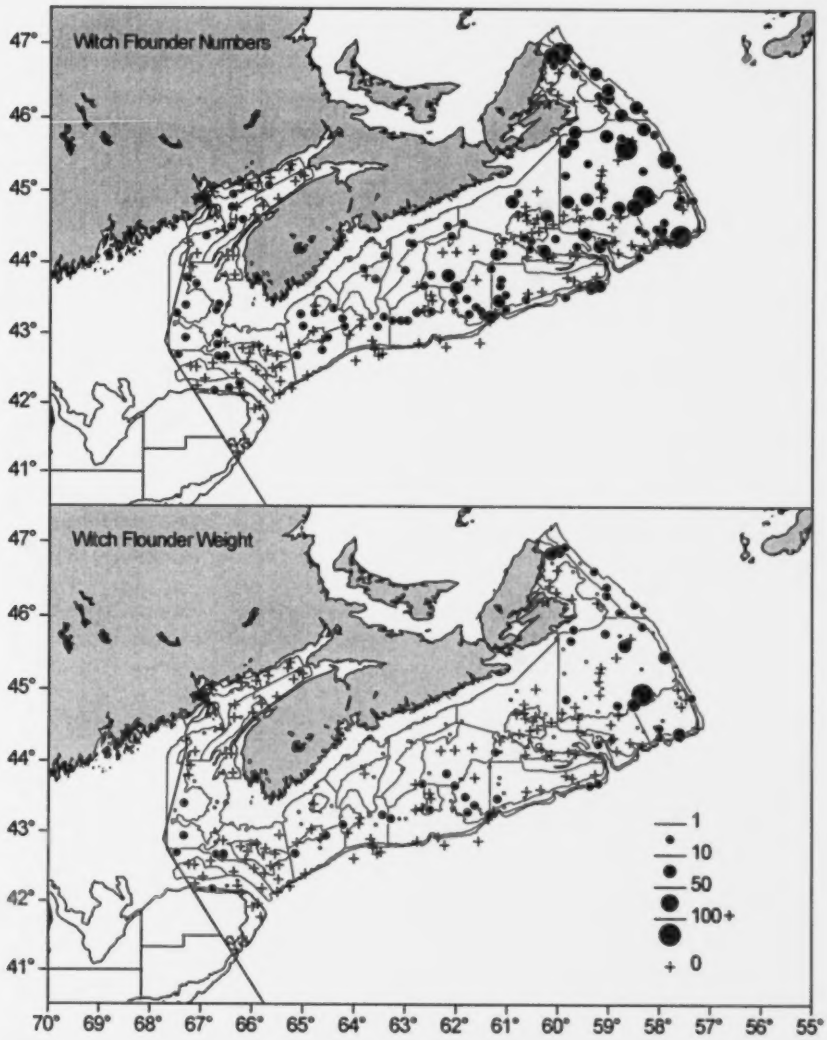

Figure 10a. Distribution of witch flounder catches during the 2011 summer RV survey.

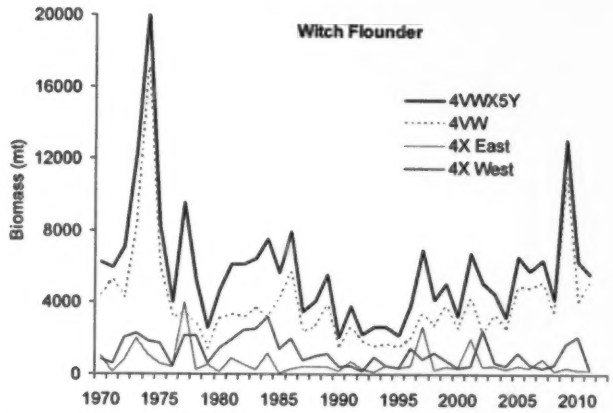

Figure 10b. Biomass estimate for witch flounder from the summer RV survey.

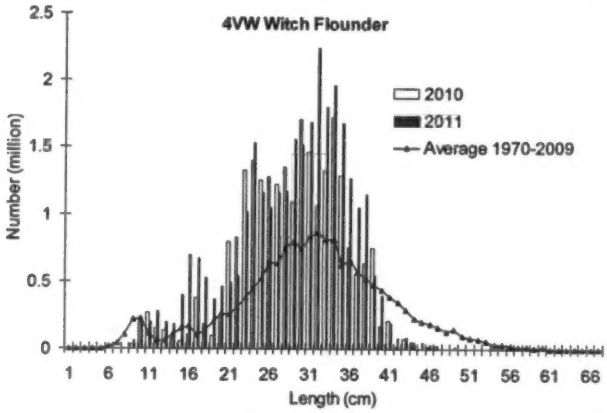

Figure 10c. Length composition for witch flounder in 4VW from the summer RV survey.

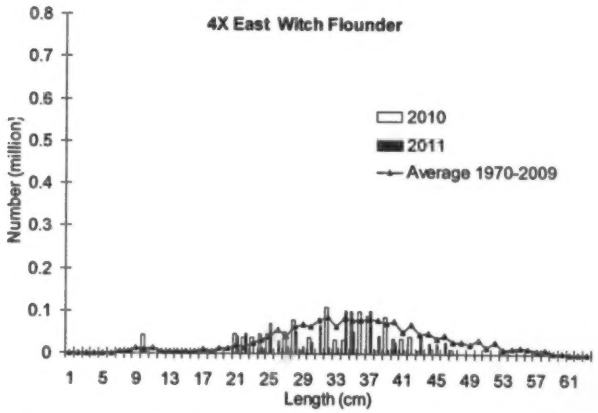

Figure 10d. Length composition for witch flounder in 4X East from the summer RV survey.

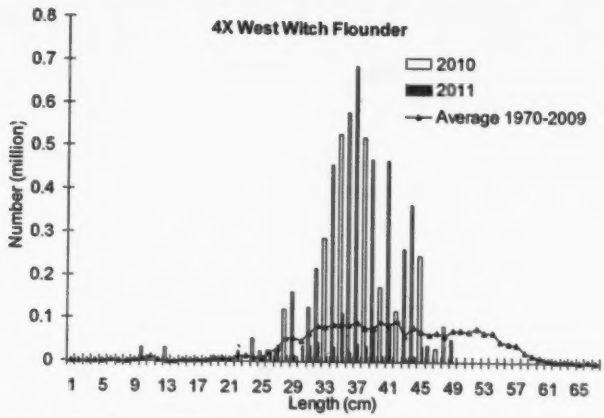

Figure 10e. Length composition for witch flounder in 4X West from the summer RV survey.

In 2011, most **yellowtail flounder** were caught in 4VW, with a small percentage caught in 4X (Fig. 11a). The biomass index for 4VW reached a low in 2003 but has since shown a general increase. In 2011, the biomass index increased and is near the short-term average and above the medium-term average but remains below the long-term average (Fig. 11b, Table 1). As in 2010, abundance of yellowtail flounder in 2011 was above average for lengths less than 27 cm, but was less than average for all lengths greater than 27 cm (Fig. 11c).

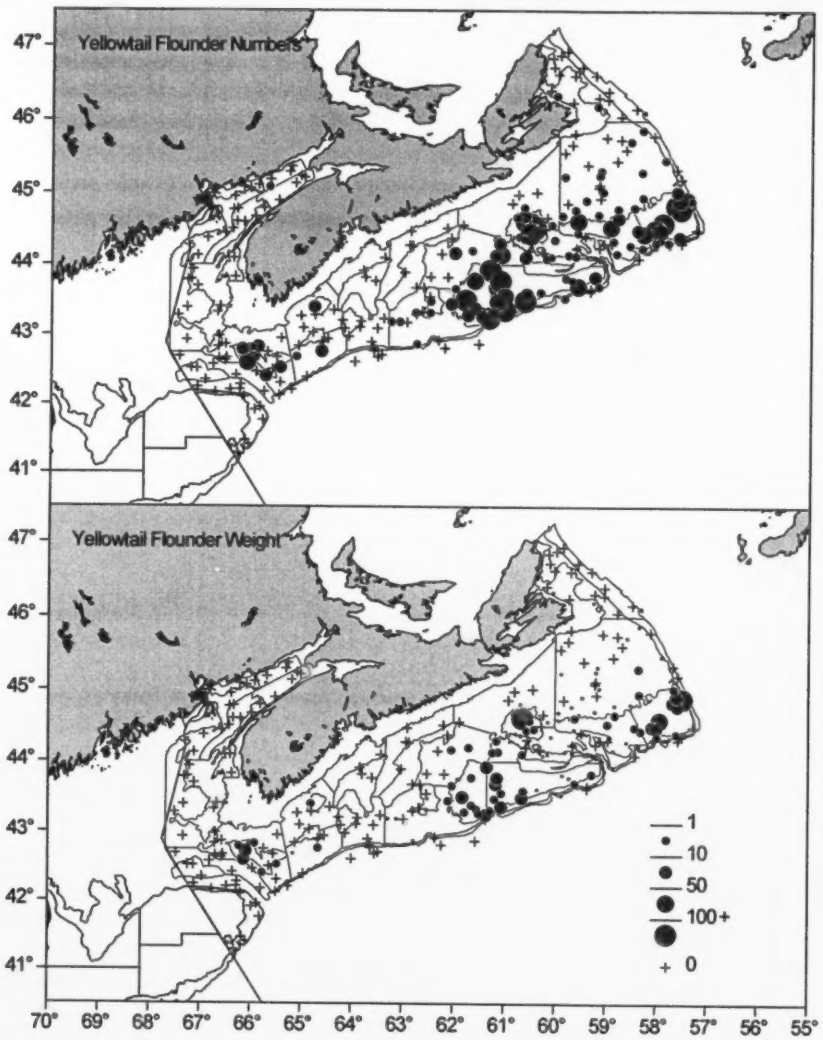

Figure 11a. Distribution of yellowtail flounder catches during the 2011 summer RV survey.

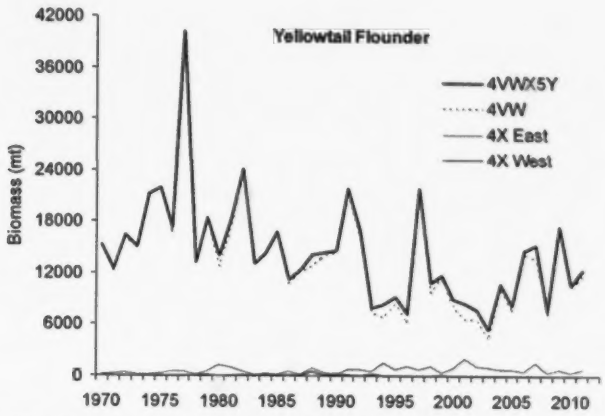

Figure 11b. Biomass estimate for yellowtail flounder from the summer RV survey.

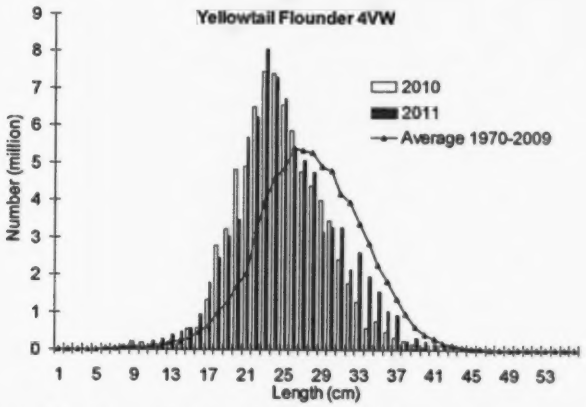

Figure 11c. Length composition for yellowtail flounder in 4VW from the summer RV survey.

Winter flounder were caught mainly in the Bay of Fundy (4Xrs) but also on Browns Bank (4Xop) (Fig. 12a). Biomass indices in 4X East in 2011 were above short, medium and long-term averages. In 4X West, the biomass index declined in 2011 from the highest in the series in 2010 and was below the short, medium and long-term averages (Fig. 12b, Table 1). Abundance indices of winter flounder in 4X East were well above average for all lengths <38 cm, (Fig. 12c). In 4X West, abundance was well below average for lengths <34 cm, and near average above 36 cm (Fig. 12d).

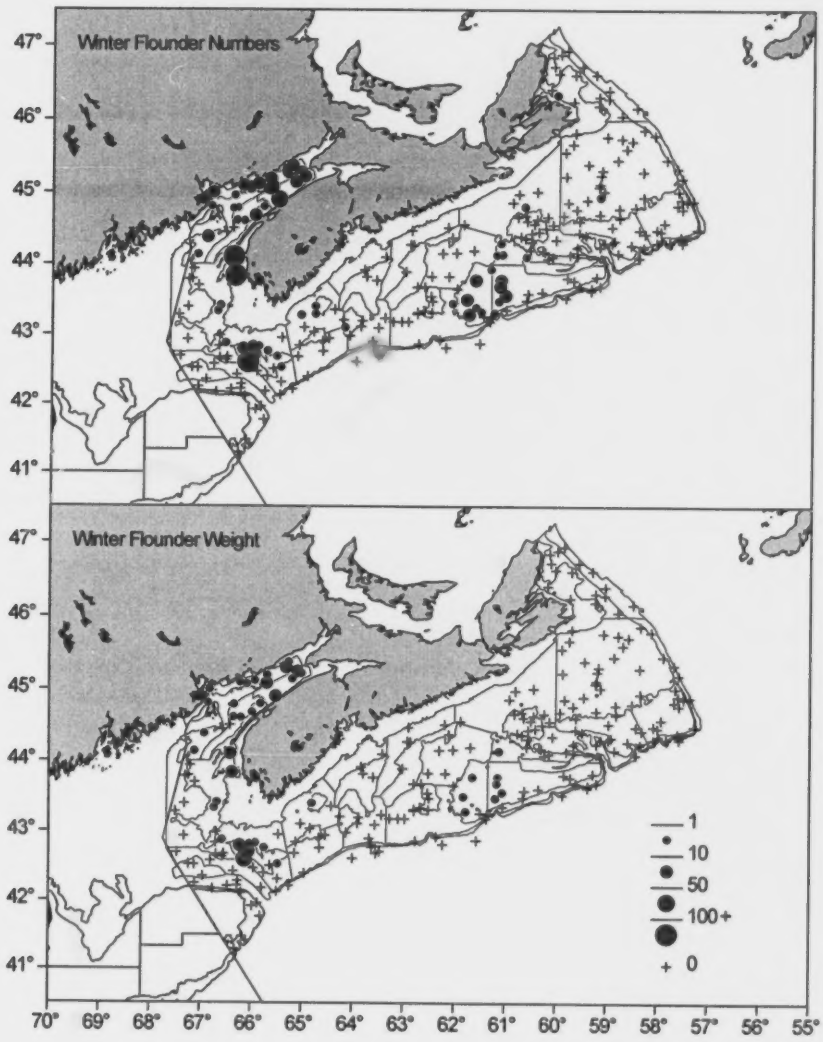

Figure 12a. Distribution of winter flounder catches during the 2011 summer RV survey.

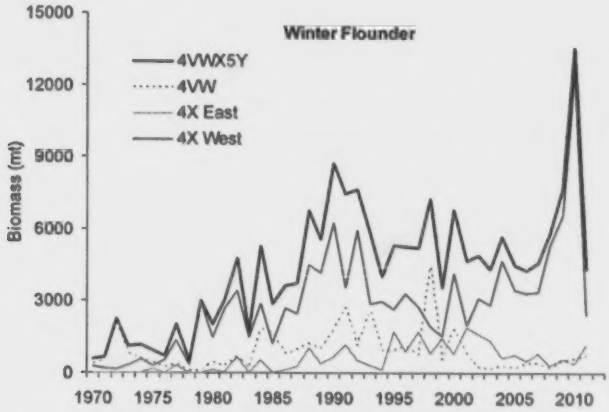

Figure 12b. Biomass estimate for winter flounder from the summer RV survey.

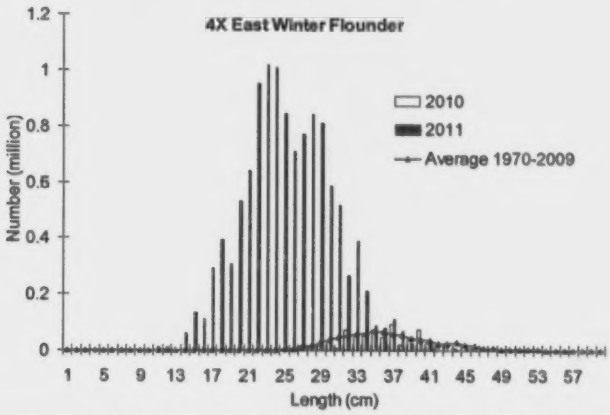

Figure 12c. Length composition for winter flounder in 4X East from the summer RV survey.

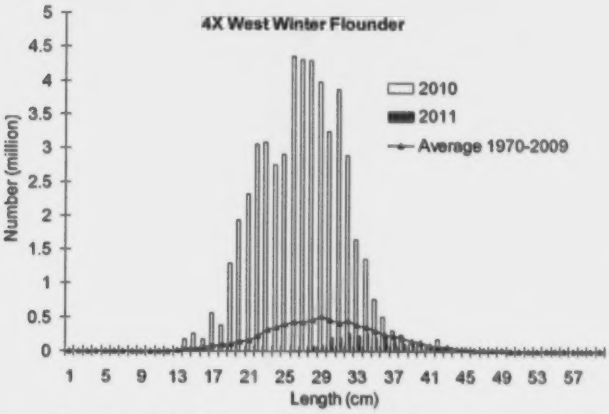

Figure 12d. Length composition for winter flounder in 4X West from the summer RV survey.

Atlantic halibut catches were widely distributed throughout the survey area (Fig. 13a). The biomass index for Atlantic halibut in 4VWX declined in 2011 from the highest point in the series in 2010, but remained above short, medium, and long-term averages (Fig. 13b, Table 1). Similar to 2010, abundance at length for 2011 was above average for most lengths (Fig. 13c).

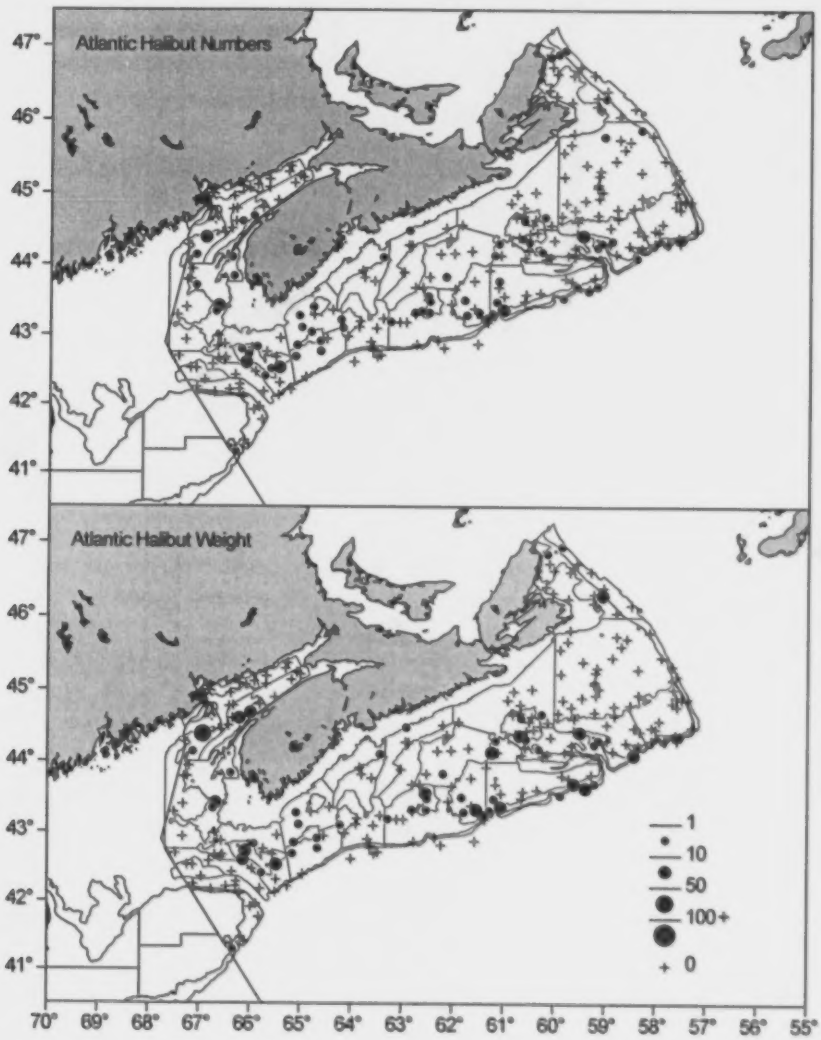

Figure 13a. Distribution of Atlantic halibut catches during the 2011 summer RV survey.

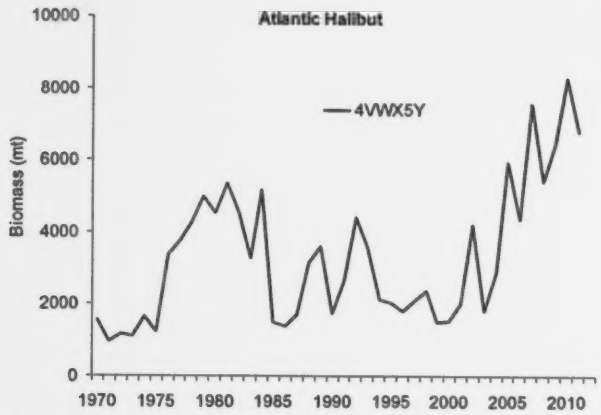

Figure 13b. Biomass estimate for Atlantic halibut from the summer RV survey.

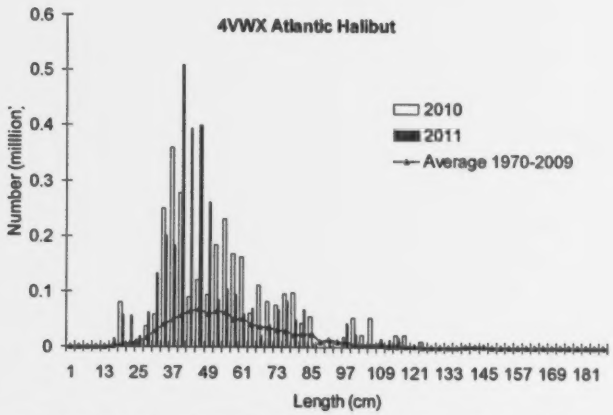

Figure 13c. Length composition for Atlantic halibut from the summer RV survey.

Atlantic wolffish were caught in a small number of sets but were distributed throughout the summer RV survey area (Fig. 14a). Biomass indices have shown a general decline for Atlantic wolffish in both the summer RV survey and the Georges Bank winter RV survey since the beginning of each time series. Biomass was below medium and long-term averages in 4X, 4VW and 5Z and above the short-term average only in 4X. Biomass indices of Atlantic wolffish were among the lowest in the series for all areas in 2011 (Figs. 14b and 14c, Table 1).

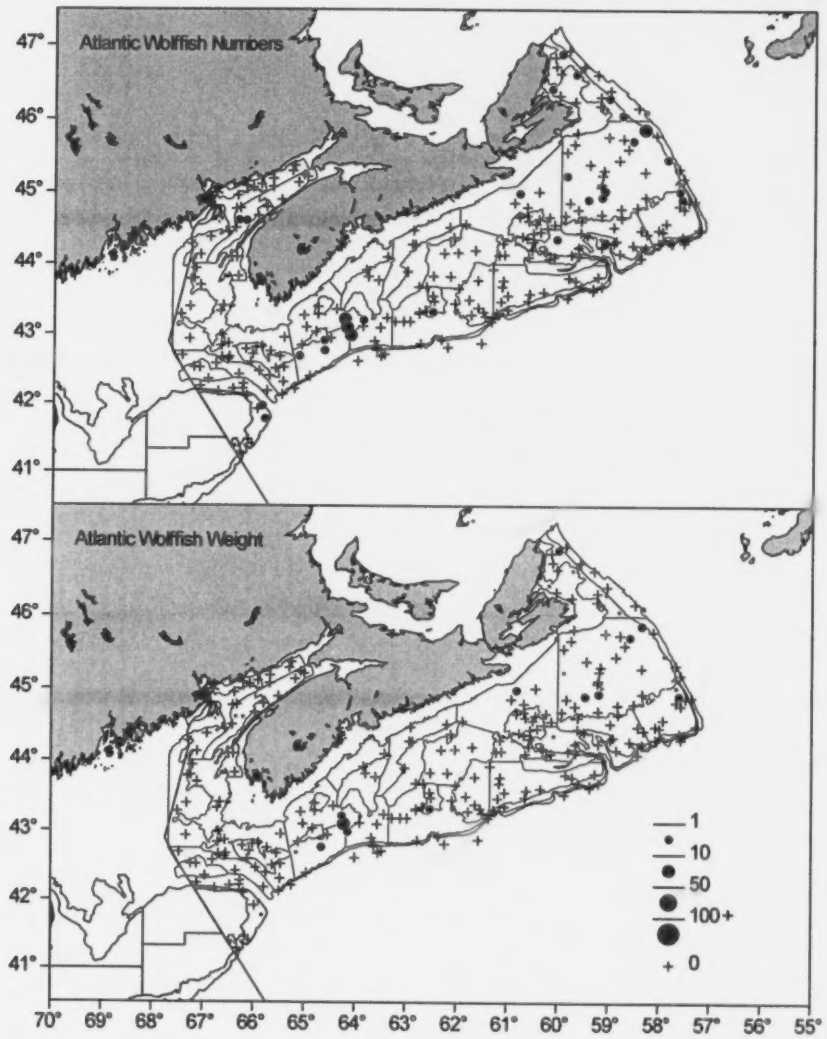

Figure 14a. Distribution of Atlantic wolffish catches during the 2011 summer RV survey.

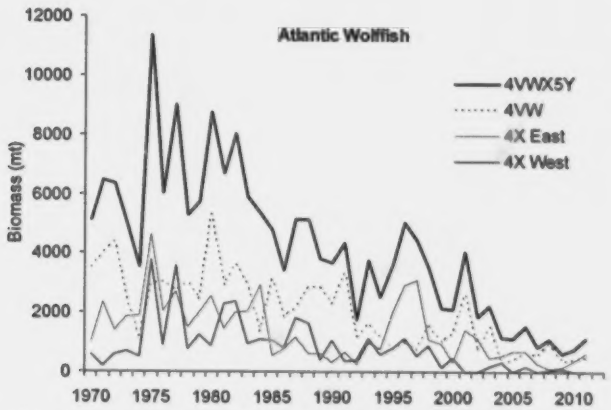

Figure 14b. Biomass estimate for Atlantic wolffish from the summer RV survey.

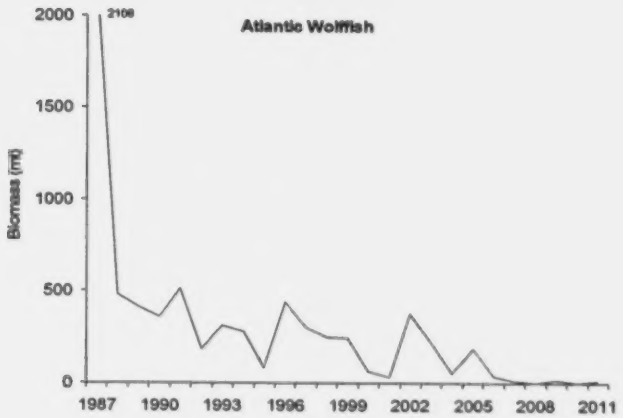

Figure 14c. Biomass estimate for Atlantic wolffish from the Georges Bank winter RV survey.

Monkfish catches were scattered widely within the summer RV survey area (Fig. 15a). Biomass indices for monkfish were below the short, medium and long-term averages in 4VW, 4X East, 4X West and 5Z in 2011(Fig. 15b and Fig. 15c, Table 1).

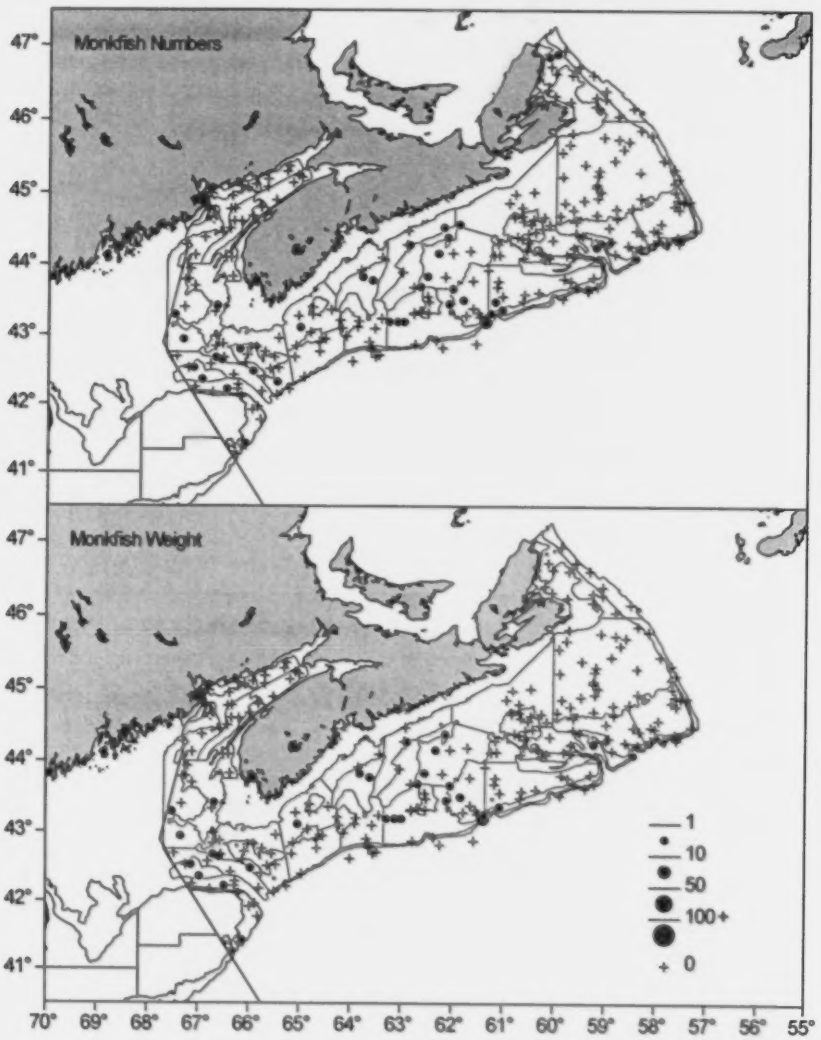

Figure 15a. Distribution of monkfish catches during the 2011 summer RV survey.

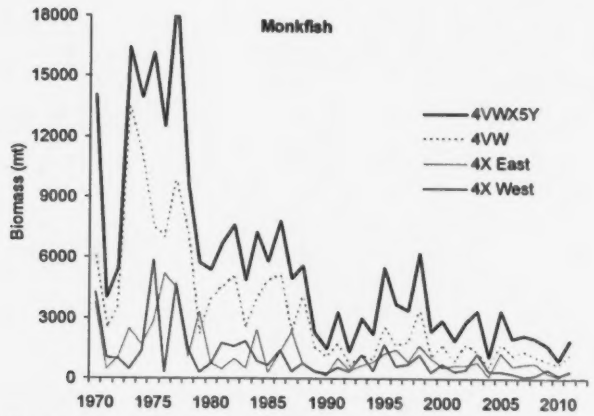

Figure 15b. Biomass estimate for monkfish from the summer RV survey.

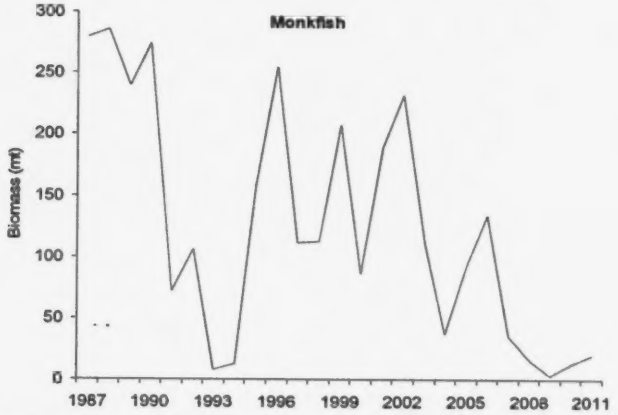

Figure 15c. Biomass estimate for monkfish from the Georges Bank winter RV survey.

In 2011, **smooth skate** were caught in a few sets distributed widely within the summer RV survey area (Fig. 16a). Smooth skate biomass indices have declined in 4VW since late 1970s and in 2011 the index was below the short, medium and long-term averages. In 4X East, biomass indices were highest in the mid 1970s but have been variable at a low level since. Biomass in 4X West declined in the late 1980s but has increased again to near the long-term average (Fig. 16b). Catches from the Georges Bank winter RV survey are sporadic and this is reflected in high inter-annual variability through the survey series variable throughout the time series (Fig. 16c). Abundance of smooth skate in 4VW was below average at most lengths, with only a few lengths represented in the catch in both 2010 and 2011 (Fig. 16d). In 4X, more lengths were present in the catch and abundance was above average for a broad range of lengths in both 2010 and 2011 (Fig. 16e). Comparison of annual length frequencies to the average for Georges Bank is not informative due to the low average catch (Fig. 16f).

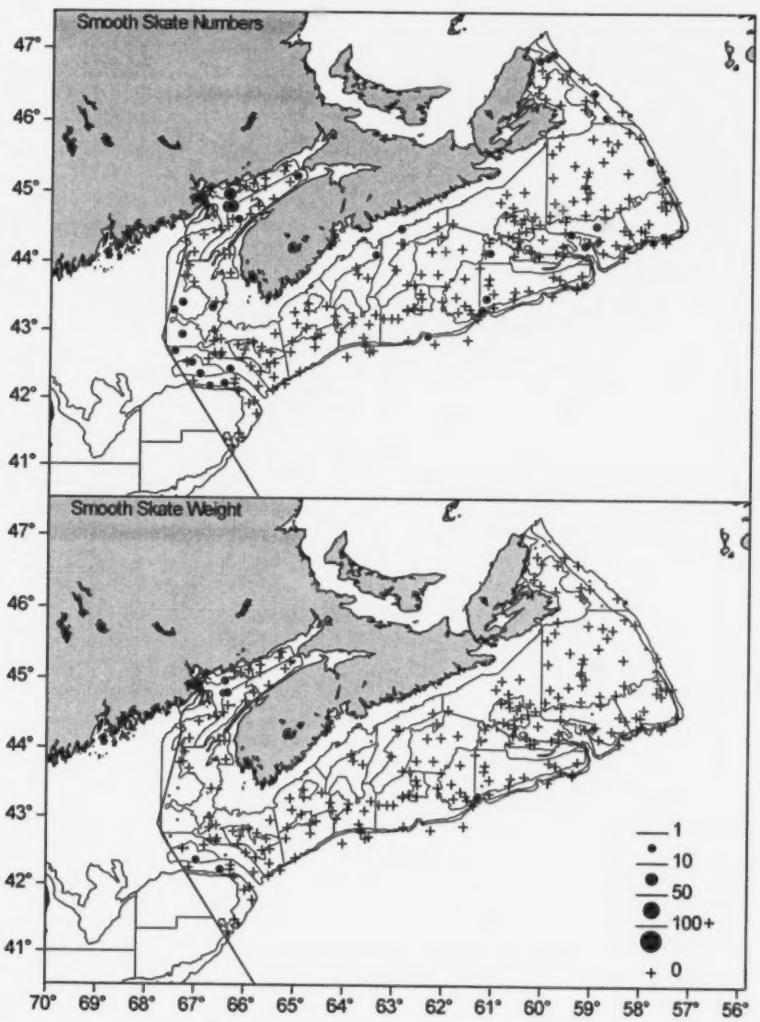

Figure 16a. Distribution of smooth skate catches during the 2011 summer RV survey.

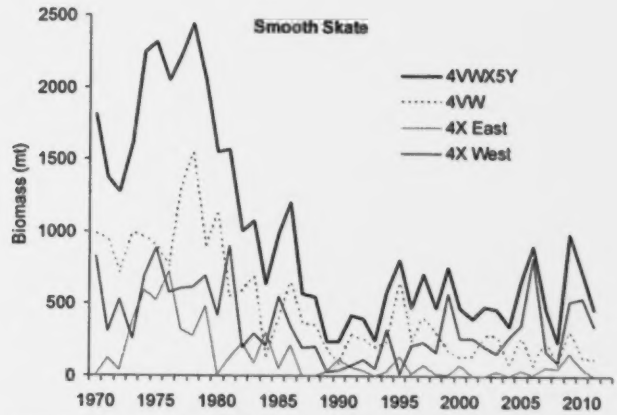

Figure 16b. Biomass estimate for smooth skate from the summer RV survey.

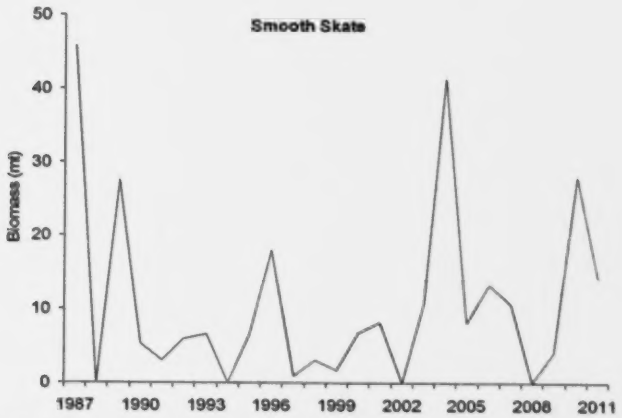

Figure 16c. Biomass estimate for smooth skate from the Georges Bank winter RV survey.

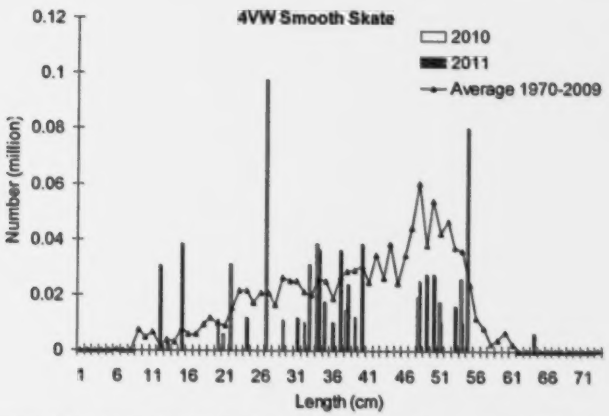

Figure 16d. Length composition for smooth skate in 4VW from the summer RV survey.

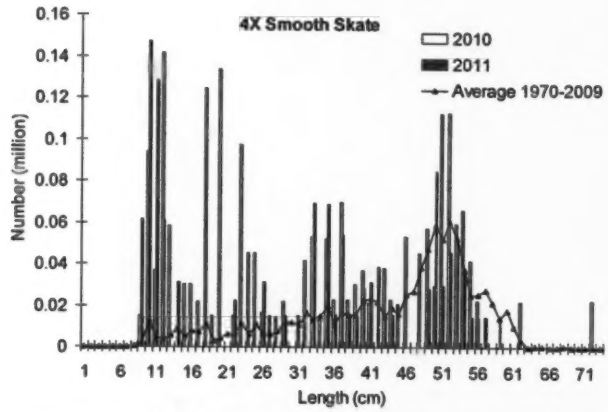

Figure 16e. Length composition for smooth skate in 4X from the summer RV survey.

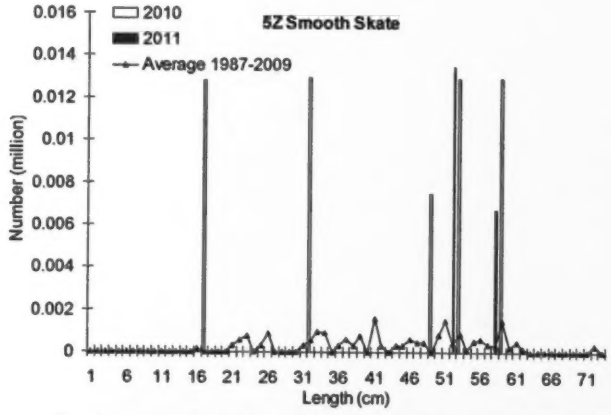

Figure 16f. Length composition for smooth skate in 5Z from the Georges Bank winter RV survey.

While **thorny skate** were caught throughout the summer RV survey area, most catches were concentrated in 4Vs (Fig. 17a). Biomass indices for thorny skate have shown a general decline from the summer RV survey. In 4VW, the biomass index has increased since 2009 (the lowest point in the series) but remains low compared to the long-term average in 2011. Biomass in 4X East and 4X West have declined as well and were at and near the lowest levels in the series respectively in 2011 (Fig. 17b). Biomass indices from the Georges Bank winter RV survey have also increased since 2009 but remain below the long-term average in 2011 (Fig. 17c). Abundance at length in 4VW was below average for nearly all lengths in 2011 (Fig. 17d). In 4X, abundance was only above or near average at lengths 12-17 cm and well below average at all other lengths (Fig. 17e). Abundance from the Georges Bank winter RV survey was near or above average for most lengths below 53 cm but there were no catches of thorny skate above 53 cm in 2010 or 2011 (Fig. 17f).

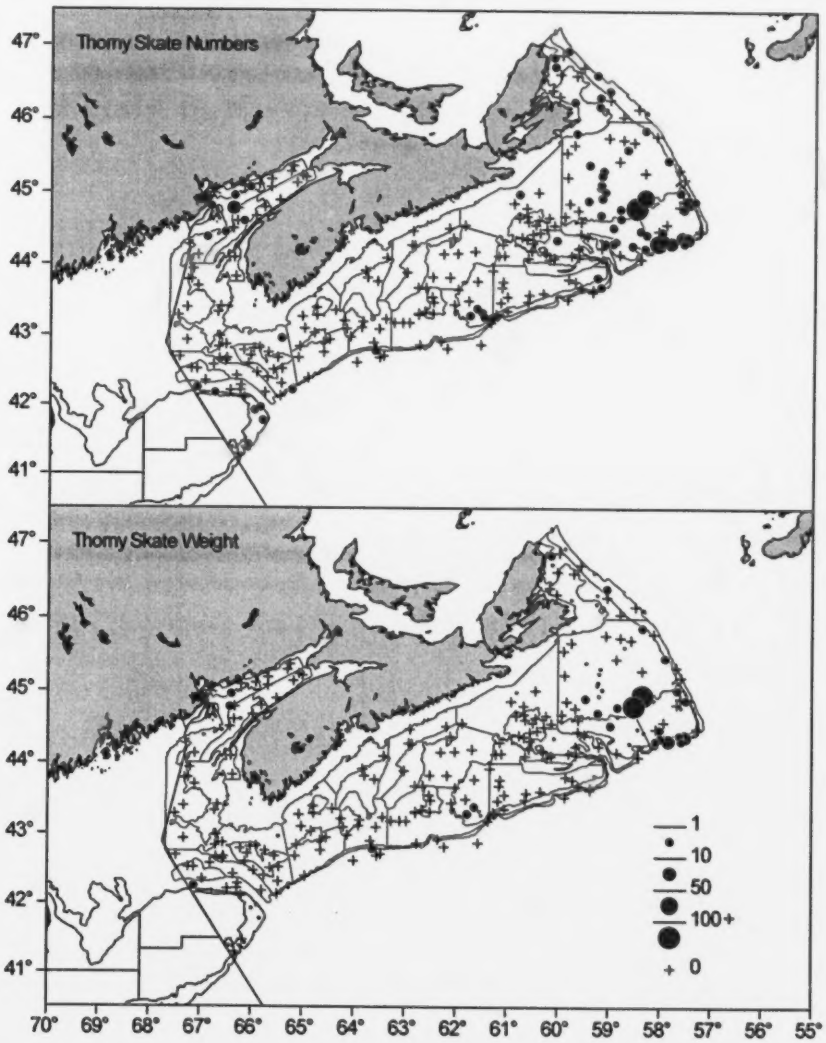

Figure 17a. Distribution of thorny skate catches during the 2011 summer RV survey.

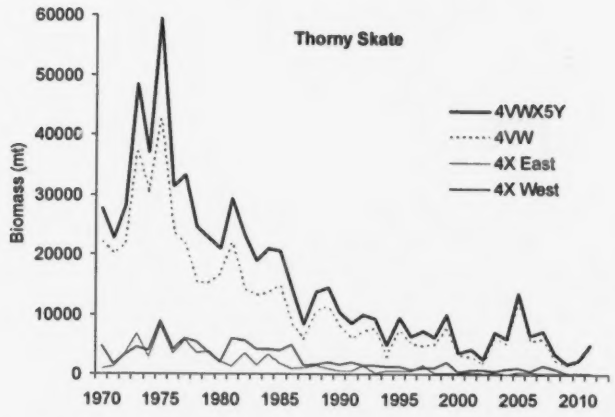

Figure 17b. Biomass estimate for thorny skate from the summer RV survey.

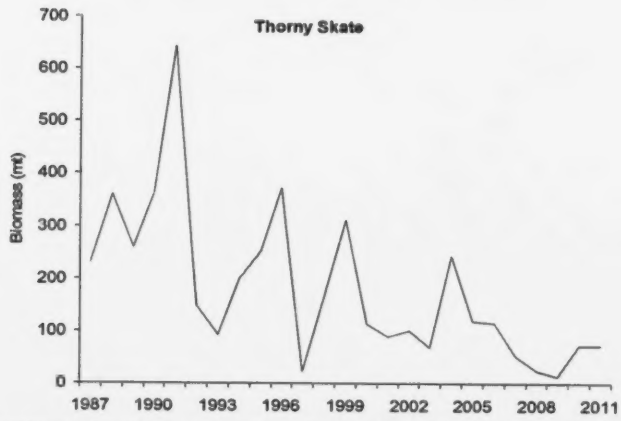

Figure 17c. Biomass estimate for thorny skate from the Georges Bank winter RV survey.

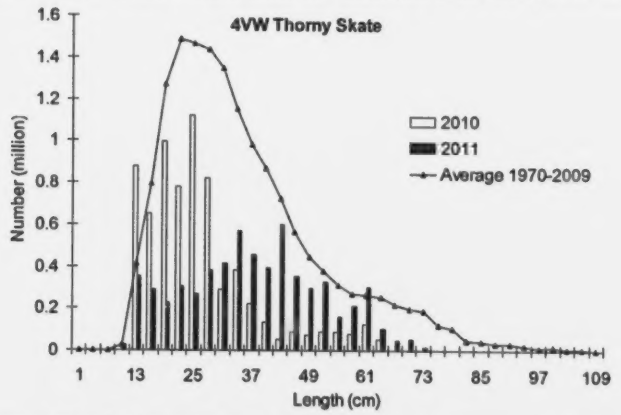

Figure 17d. Length composition for thorny skate in 4VW from the summer RV survey.

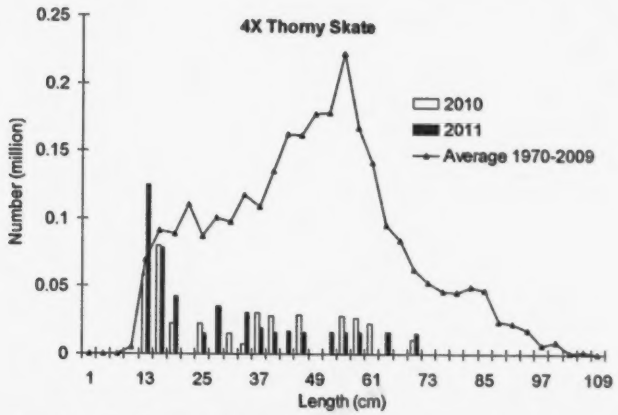

Figure 17e. Length composition for thorny skate in 4X from the summer RV survey.

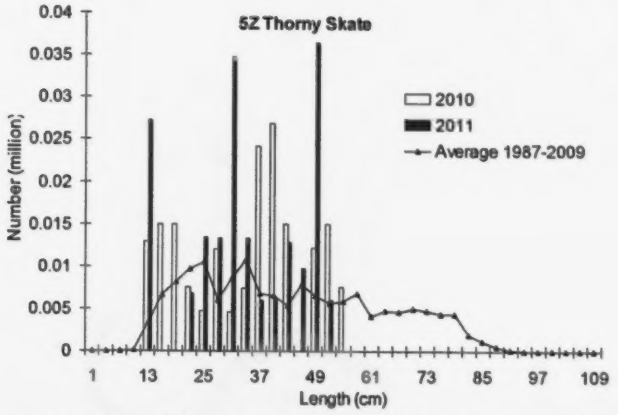

Figure 17f. Length composition for thorny skate in 5Z from the Georges Bank winter RV survey.

Barndoor skate were infrequently caught in the 2011 summer RV survey but catches were distributed throughout the area (Fig. 18a). Biomass indices for barndoor skate from the summer RV survey show high inter-annual variability. Biomass estimates were above the long-term average in 4X East and 4VW in 2010 and 2011, but declined in 4X West from above average in 2010 to below average in 2011 (Fig. 18b). For the Georges Bank winter RV survey, biomass has increased since 2008 and was above the long-term average in 2010 and 2011 (Fig. 18c). Abundance at length from the summer RV survey shows that few fish are caught at any length (Figs. 18d and 18e). The Georges Bank winter RV survey abundance at length was above average for most lengths in 2011 (Fig. 18f).

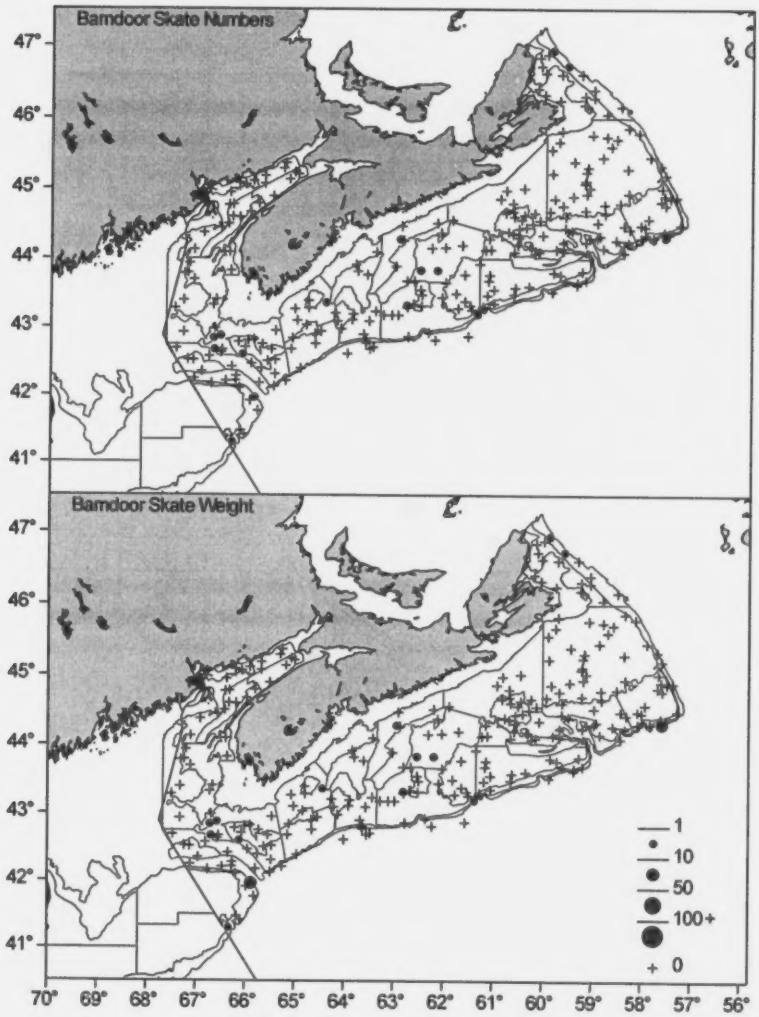

Figure 18a. Distribution of barndoor skate catches during the 2011 summer RV survey.

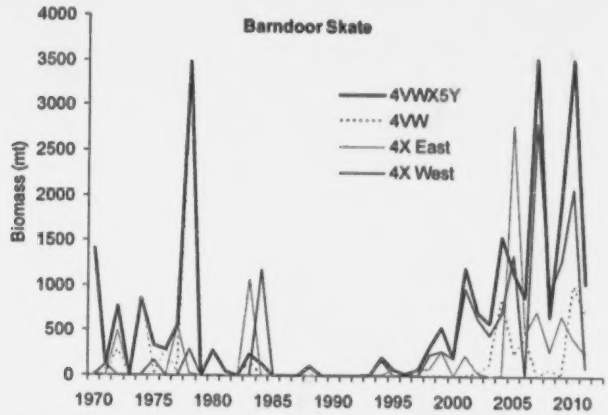

Figure 18b. Biomass estimate for barndoor skate from the summer RV survey.

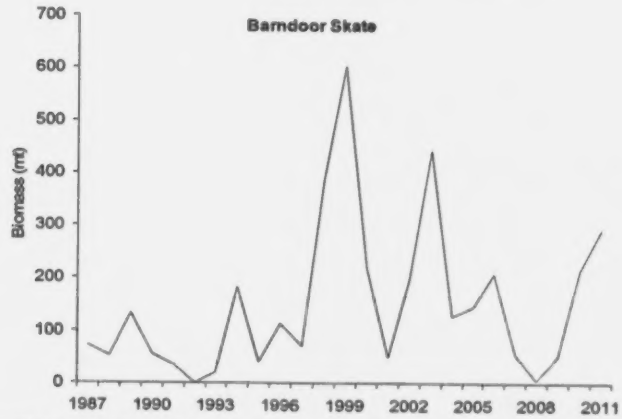

Figure 18c. Biomass estimate for barndoor skate from the Georges Bank winter RV survey.

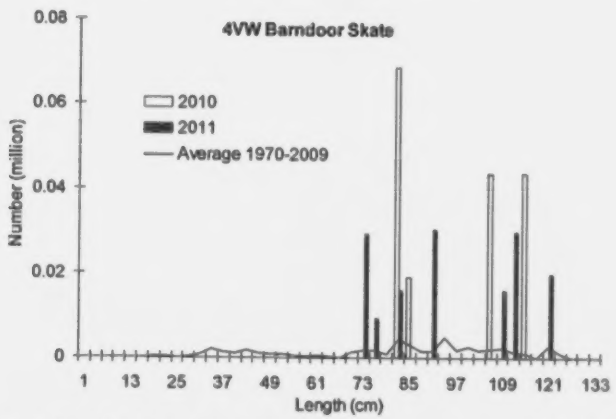

Figure 18d. Length composition for barndoor skate in 4VW from the summer RV survey.

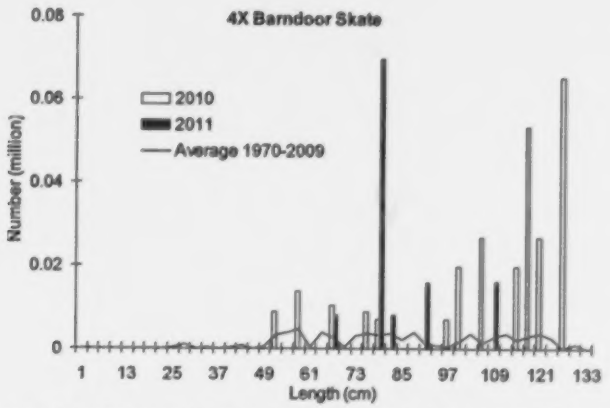

Figure 18e. Length composition for barndoor skate in 4X from the summer RV survey.

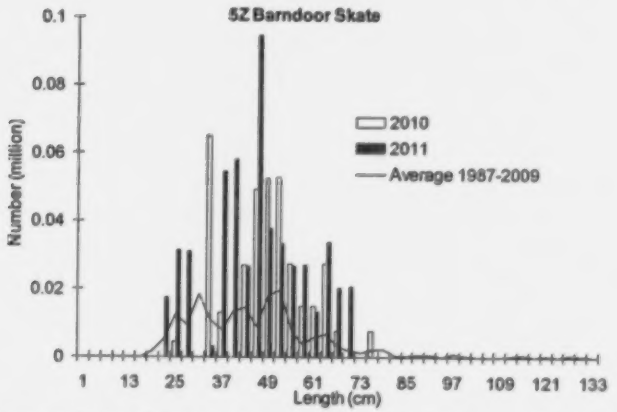

Figure 18f. Length composition for barndoor skate in 5Z from the Georges Bank winter RV survey.

Winter skate and **little skate** cannot be reliably distinguished at lengths less than about 35 cm. Given that the majority of the winter and little skates captured in the surveys are in this length range, the biomass trends are influenced by the contribution of fish for which identification is uncertain. For both 4X and 5Z, the abundances of small skates attributed to these two species in 2010 and 2011 were well above average, while the larger sizes were generally below average.

Most **winter skate** catches in the 2011 summer RV survey came from 4Xp and 4Xrs but some were also caught in 4Vs (Fig. 19a). Winter skate biomass index from the summer RV survey has declined in 4VW since the beginning of the survey and was among the lowest in the series in 2011. Biomass indices in 4X East and 4X West do not show the same trend; the biomass index was above average in 4X East and below average in 4X West in 2011 (Fig. 19b). The biomass index for winter skate from the Georges Bank winter RV survey has also declined and is near the lowest in the series in 2011 (Fig. 19c). Abundance at length in 4VW shows few winter skate were caught in 2010, and below average catches for most lengths in 2011 (Fig. 19d). In 4X, abundance from 2011 was above average for lengths <41 cm but below average for most other lengths (Fig. 19e). Abundance of winter skate from the Georges Bank winter RV survey was above average for lengths between 15 cm and 38 cm in 2011, but below average at all other lengths (Fig. 19f).

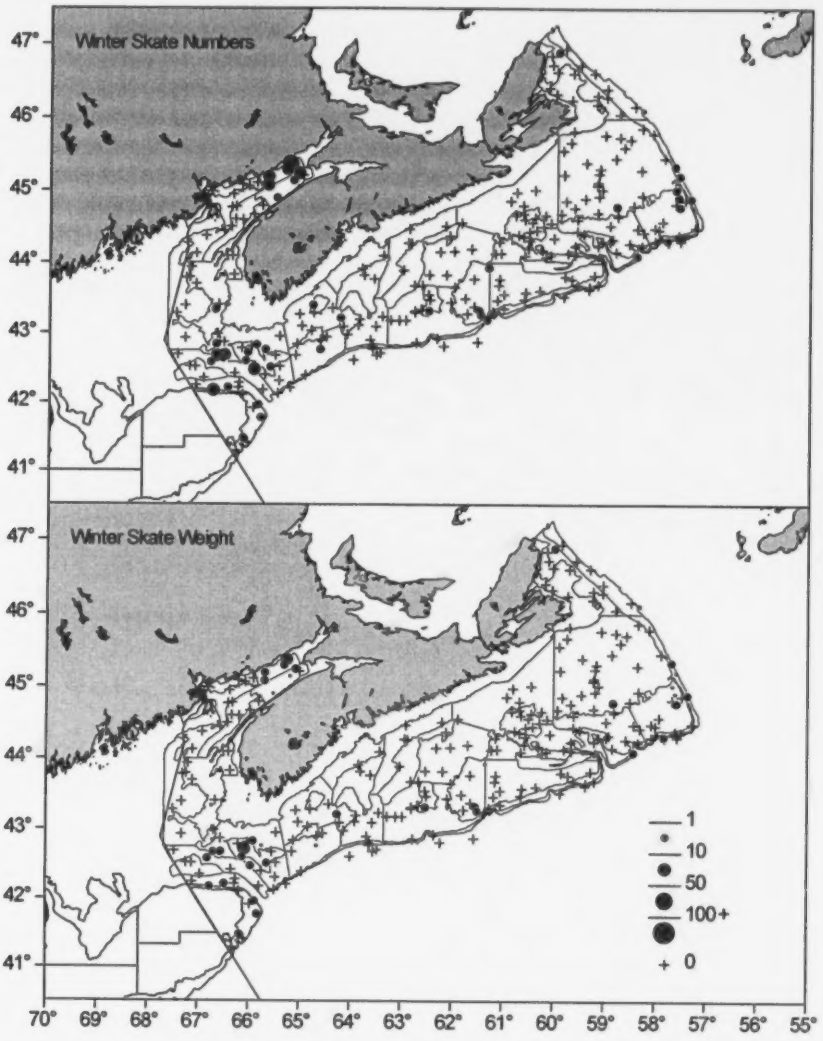

Figure 19a. Distribution of winter skate catches during the 2011 summer RV survey.

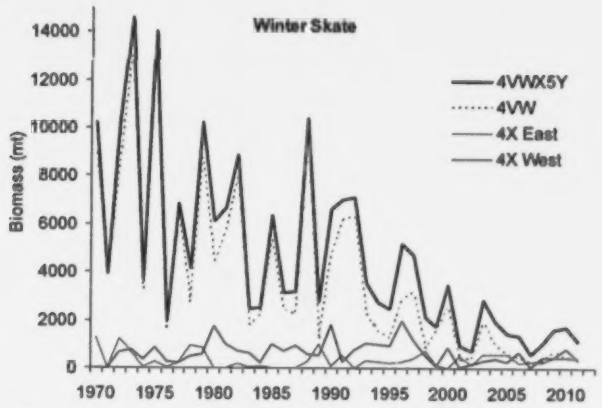

Figure 19b. Biomass estimate for winter skate from the summer RV survey.

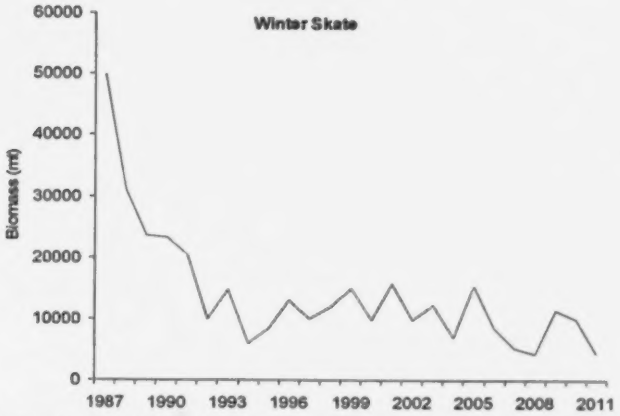

Figure 19c. Biomass estimate for winter skate from the Georges Bank winter RV survey.

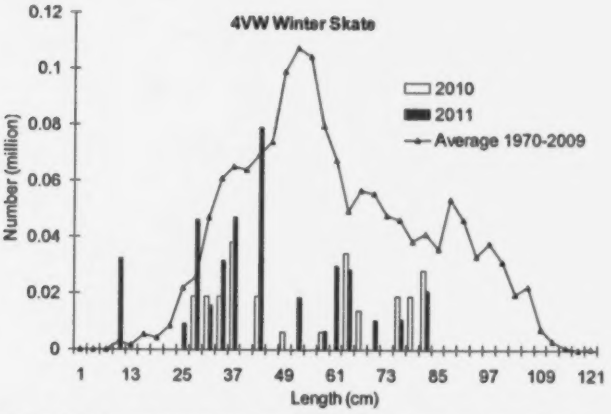

Figure 19d. Length composition for winter skate in 4VW from the summer RV survey.

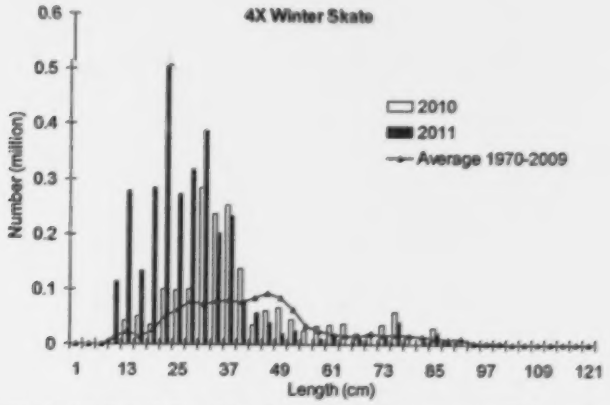

Figure 19e. Length composition for winter skate in 4X from the summer RV survey.

Figure 19f. Length composition for winter skate in 5Z from the Georges Bank winter RV survey.

Similar to winter skate, most **little skate** catches from the summer RV survey came from 4Xp and 4Xrs (Fig. 20a). Little skate biomass indices display high inter-annual variability (Fig. 20b). In 2011, the index was above the long-term average in 4X East, but below the long-term average in 4X West and in 4VW. Biomass from the Georges Bank winter RV Survey also displays wide inter-annual variability, but in 2011 dropped to the lowest level in the series (Fig. 20c). Abundance in 4VW was above average for the lengths encountered but many lengths were absent from the catch (Fig. 20d). In 4X, abundance was near or above average for most lengths less than 51 cm (Fig. 20e). From the Georges Bank winter RV survey, abundance at length was above average for most lengths less than 35 cm but below average for larger fish (Fig. 20f).

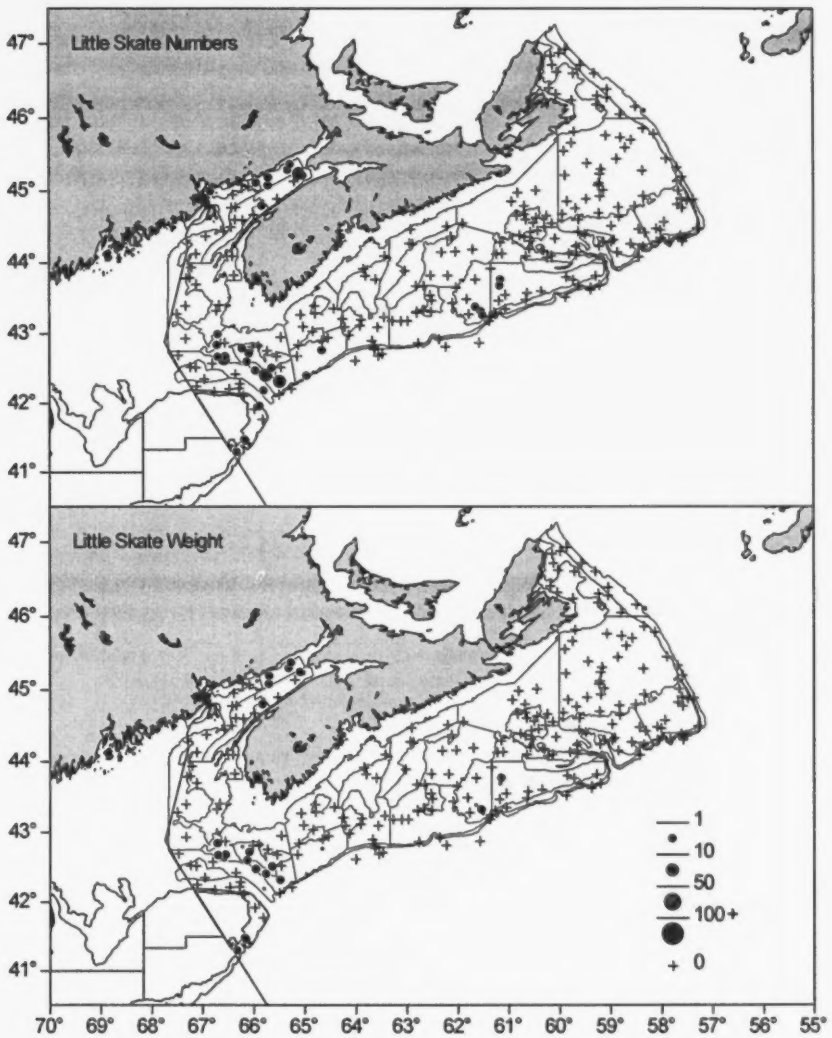

Figure 20a. Distribution of little skate catches during the 2011 summer RV survey.

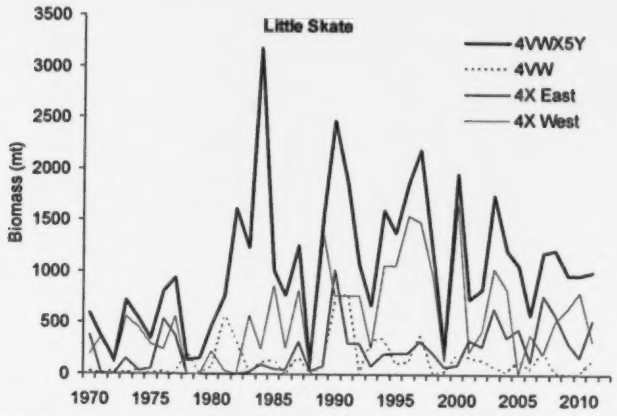

Figure 20b. Biomass estimate for little skate from the summer RV survey.

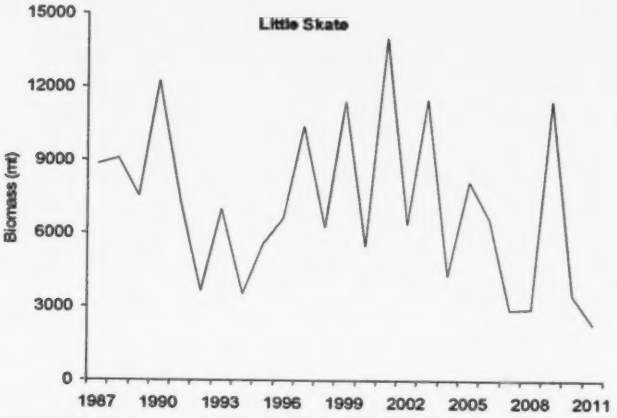

Figure 20c. Biomass estimate for little skate from the Georges Bank winter RV survey.

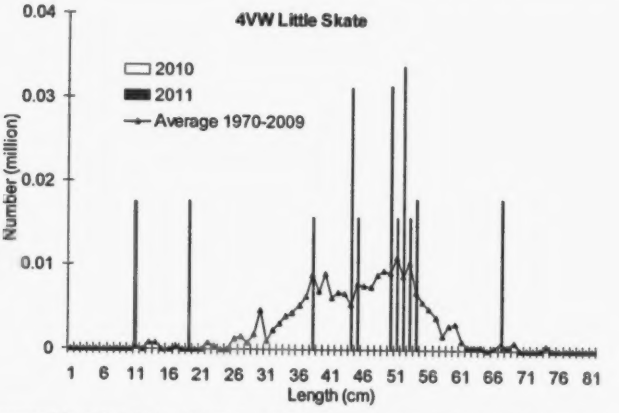

Figure 20d. Length composition for little skate in 4VW from the summer RV survey.

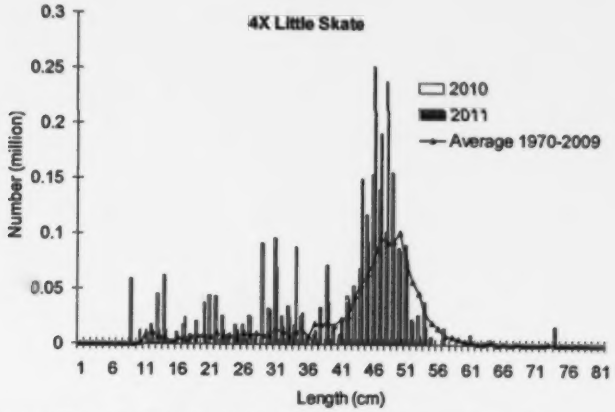

Figure 20e. Length composition for little skate in 4X from the summer RV survey.

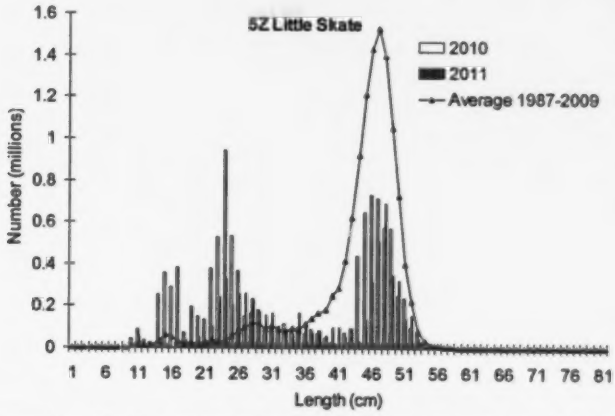

Figure 20f. Length composition for little skate in 5Z from the Georges Bank winter RV survey.

Longhorn sculpin were distributed throughout most of the survey area, with few catches in 4Vn (Fig. 21a). In 2011 the biomass index was the lowest in the series in 4VW, below the long-term average in 4X West, but above the long-term average in 4X East (Fig. 21b). Biomass indices from the Georges Bank winter RV survey has also displayed high inter-annual variability, but declined in 2011 to the lowest level in the series (Fig. 21c)

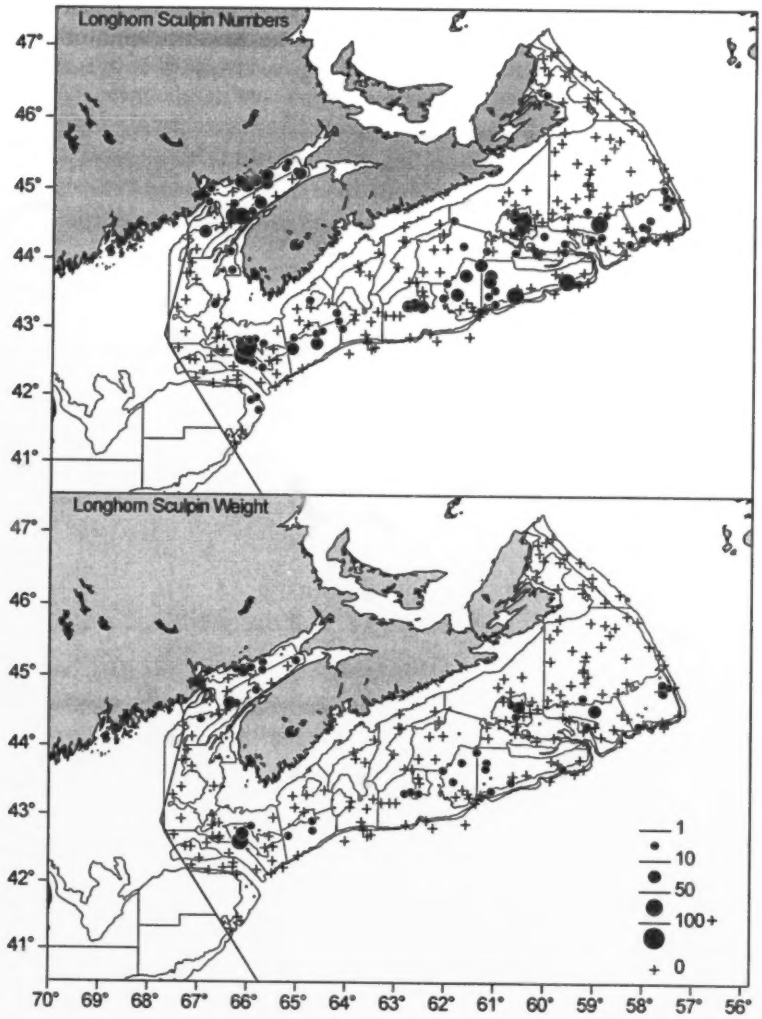

Figure 21a. Distribution of longhorn sculpin catches during the 2011 summer RV survey.

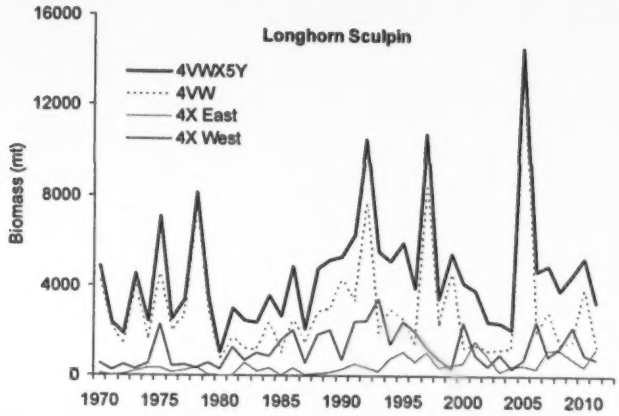

Figure 21b. Biomass estimate for longhorn sculpin from the summer RV survey.

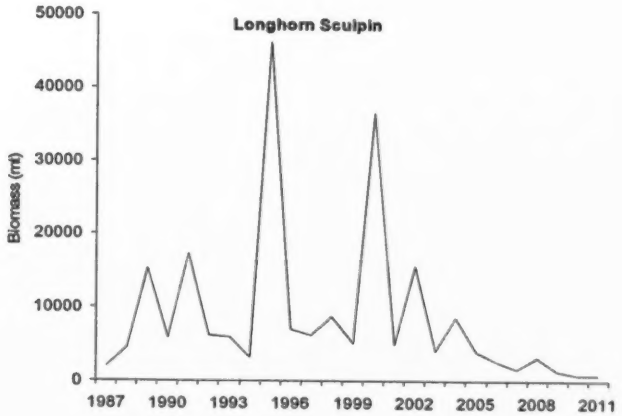

Figure 21c. Biomass estimate for longhorn sculpin from the Georges Bank winter RV survey.

Spotted wolffish have been infrequently caught in the summer RV survey, with only 52 fish caught since the beginning of the standardized survey program in 1970. Most of those catches came from 4V (Fig. 22). No spotted wolffish have been caught during the summer RV survey since 2008, and none have been caught in the Georges Bank winter RV survey.

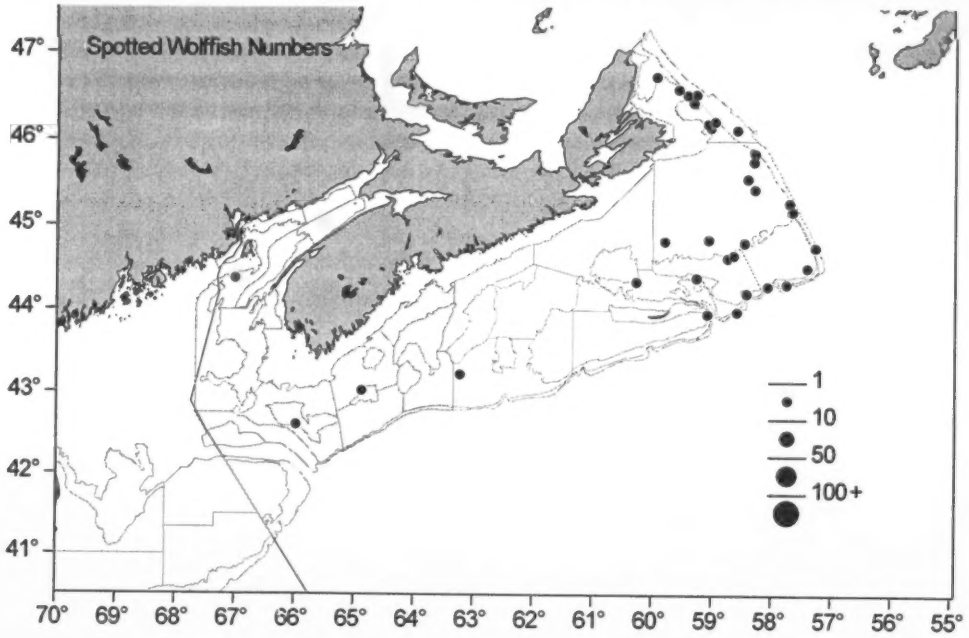

Figure 22. Catch distribution for spotted wolffish from Maritimes region RV surveys since 1970.

Very few **northern wolffish** have been caught in the summer RV survey series, with only 58 fish being caught throughout the survey history since 1970. Most catches came from 4V, but some were also encountered along the shelf edge in 4WX (Fig. 23). In 2011, three northern wolffish were caught during the summer RV survey, but these were captured in exploratory sets at around 900 m depth, much deeper than the standard coverage for this survey. Only one northern wolffish has been caught during the Georges Bank winter RV survey series.

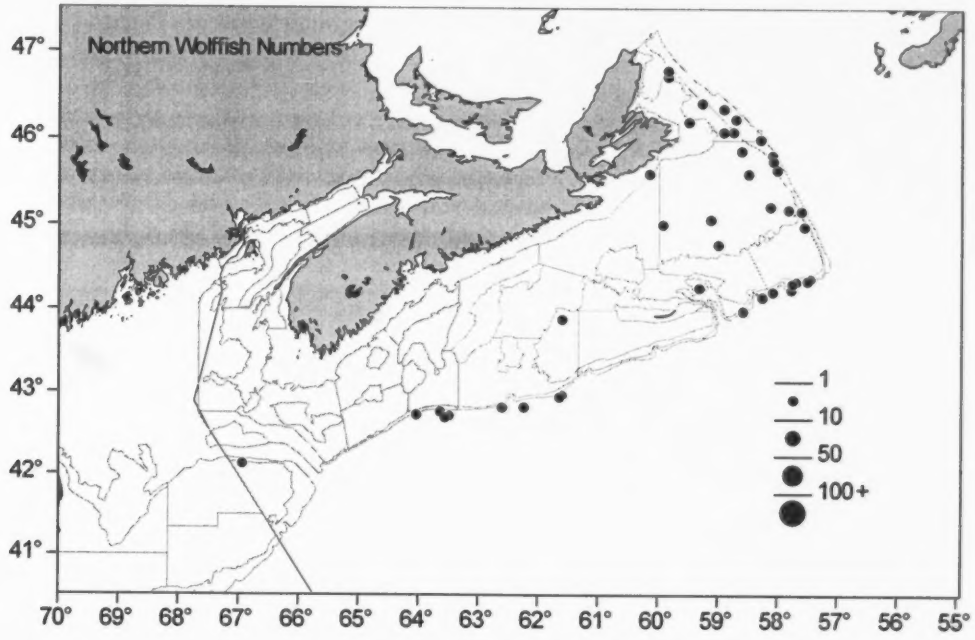

Figure 23. Catch distribution for northern wolffish from Maritimes region RV surveys since 1970.

Conclusions

Biomass indices are compared with the averages over 3 time periods; short-term being most recent 5 year average, medium-term being most recent 15 year average and long-term being since the beginning of the survey series, or the period deemed appropriate for that particular species.

- Biomass indices for 4X cod were below short, medium and long-term averages in 2011.
- The biomass index for 4Vn cod was above the short-term averages in 2011 but below the medium and long-term averages.
- The biomass index for 4VsW cod in 2011 was above the short and medium-term averages but below the long-term average.
- The biomass index for 4VW haddock in 2011 declined to the lowest seen since 1976 and was below short, medium and long-term averages.
- The biomass index for 4X white hake in 2011 was below short, medium and long-term averages.
- The biomass index for 4VW white hake was below short, medium and long-term averages in 2011.

- The biomass index of 4VWX5 silver hake in 2011 was above short, medium and long-term averages.
- The biomass indices for 4VW pollock and 4X pollock in 2011 were above short, medium and long-term averages.
- The biomass index for redfish in 4VW was above the short medium and long-term average in 2011.
- The biomass index for redfish in 4X was below the short-term average but above the medium and long-term averages in 2011.
- Winter flounder biomass index in 4X in 2011 was below the short and medium-term averages, but above the long-term average.
- Biomass indices for 4VW and 4X American plaice in 2011 were below short, medium and long-term averages.
- The biomass index for halibut in 4VWX was above the short medium and long-term average in 2011.
- Biomass indices for Atlantic wolffish in 2011 in 4VW, 4X and 5Z were among the lowest in the respective time-series.
- Biomass indices for monkfish in 2011 in 4VW, 4X and 5Z were among the lowest in the respective time-series.
- The biomass index for smooth skate in 2011 in 5Z was above the short, medium and long-term averages. In 4X the biomass index was above the medium-term average but below the short and long-term averages. In 4VW the biomass index was below the short, medium and long-term averages.
- Biomass indices for thorny skate in 4X, 4VW and 5Z in 2011 were among the lowest in the time-series.
- Biomass indices for barndoor skate were above short, medium and long-term averages in 2011 in 5Z and 4VW. In 4X, biomass indices in 2011 were above the medium term average but below the short and long-term averages.
- Biomass indices for winter skate in 2011 were below short, medium and long-term averages in 5Z, 4X and 4VW and 5Z.
- Biomass indices for little skate in 4X in 2011 were above short and long-term averages but below the medium-term average. In 5Z the biomass index in 2011 was the lowest in the time-series and in 4VW it was below short, medium and long-term averages.
- The biomass index for longhorn sculpin in 4X in 2011 was below the short and medium-term averages but above the long-term average. In 4VW and 5Z, the biomass indices in 2011 were below the short, medium and long-term averages.
- Spotted wolffish and northern wolffish have been captured in surveys in 5Z and 4X very infrequently. Catches in 4VW, while more common than further west, are too sporadic to derive a biomass index series.

Contributors

Name	*Affiliation*
Donald Clark	St. Andrews Biological Station, DFO
Jamie Emberley	St. Andrews Biological Station, DFO
Kirsten Clark	St. Andrews Biological Station, DFO
Heath Stone	St. Andrews Biological Station, DFO
Peter Hurley	Bedford Institute of Oceanography, DFO
Jim Simon	Bedford Institute of Oceanography, DFO
Verna Docherty	Fisheries Management, DFO
Wendy Williams	Fisheries Management, DFO

Tana Worcester Bedford Institute of Oceanography, DFO

Approved by

Alain Vézina
Regional Director of Science, DFO Maritimes Region
Dartmouth, Nova Scotia
Ph. 902-426-3490
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Sources of Information

Clark, D.S., and Emberley, J. 2011. Update of the 2010 Summer Scotian Shelf and Bay of Fundy Research Vessel Survey. Can. Data Rep. Fish. Aquat. Sci. 1238

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Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
PO Box 1006, Station B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Telephone: 902-426-7070
Fax: 902-426-5435
E-Mail: XMARMRAP@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

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